

Medizintechnik Gruppe

Forschung

Bei unserer Forschung im Feld der Medizintechnik fokussieren wir uns auf die interdisziplinäre Schnittstelle von Intensivmedizin, Datenanalyse, Maschinellem Lernen, Regelungstechnik und eingebetteter Software. Hierbei sind wir besonders an datenbasierter Früherkennung von Krankheitsbildern und Gerätestörungen, sowie modellbasierter Regelung von Organunterstützenden Systemen interessiert.



Projekte

Aix-Neo-Guard

Die Digitalisierung der intensivmedizinischen Arbeitsumgebung ermöglicht die Zusammenführung von Patientendaten aus Diagnostik und Therapie, wodurch multiparametrische, hochfrequente Datenkollektionen entstehen. Während solche Datenbanken für Erwachsene bereits öffentlich zugänglich etabliert sind, fehlt im Bereich der neonatologischen und pädiatrischen Intensivmedizin die Datengrundlage, um vielfältige Krankheitsbilder systemisch zu modellieren oder Methoden der künstlichen Intelligenz (KI) einzusetzen.



Das Projekt Aix-Neo-Guard welches den erzeugten Datensatz eines vorherigen Projekts Nanni nutzt und erweitert, hat als übergeordnetes Ziel die Verbesserung intensivmedizinischer Diagnostik und Therapie im Neonatal-, Kindes- und Jugendalter durch Erhöhung der Therapiesicherheit und Verbesserung der medizinischen Ausbildung.

Durch den Einsatz KI-basierter Algorithmen wird die Früherkennung von Behandlungs-Komplikationen möglich und es entstehen vertiefte Einblicke in pathophysiologische Zusammenhänge. Darüber hinaus wird ein physiologisches Modell zur Abbildung des pulmonalen Gasaustausches unter mechanischer Ventilation erarbeitet, welches in der Zukunft sowohl die Ausbildung von medizinischem Personal als auch die Therapie direkt unterstützen könnte. Als erste konkrete Schritte wurden bereits KI-Methoden wie Random Forest oder rekurrente Neuronale Netze auf hochaufgelöste Zeitreihendaten angewendet, um Patienten-Ventilator Asynchronitäten automatisiert zu erkennen.

Ansprechpartnerin: [Camelia Oprea, M.Sc. RWTH](#)

Erklärbare Künstliche Intelligenz

Im Kontext der Projekte „SMITH“, sowie „Aix-Neo-Guard“ beschäftigen wir uns mit dem Thema der erklärbaren und interpretierbaren künstlichen Intelligenz, bzw. dem erklärbaren und interpretierbaren Machine Learning. Hierbei werden alle Aspekte des Data-Processings in Betracht genommen: Eine übersichtliche und gute visuelle Darstellung der vorhandenen Daten um Medizinern das Arbeiten mit den Daten zu erleichtern; Frameworks, die bestehende Machine Learning Verfahren um eine Auswahl von Erklärbarkeit und Interpretierbarkeit erweitern können; Von Grund auf für Erklärbarkeit und Interpretierbarkeit entwickelte Machine Learning Verfahren; Erweiterte Auswertungsverfahren für Machine Learning, die über einzelne Werte hinaus die Fähigkeiten und Schwächen der Verfahren darlegen.

Ansprechpartner: [Simon Fonck, M.Sc. RWTH](#), [Alexander Kruschewsky, M.Sc. RWTH](#), [Camelia Oprea, M.Sc. RWTH](#)

SMITH

Innerhalb des [SMITH-Projektes](#) werden innovative IT-Lösungen zur Verbesserung der medizinischen Patientenversorgung entwickelt. Mit Hilfe von Datenintegrationszentren (DIZ) und einem im Projekt entwickelten Marketplace wird die interoperable Nutzung von Daten und der patientenorientierten Forschung ermöglicht. Anhand von drei Anwendungsfällen soll der Mehrwert dieser Dateninteroperabilität gezeigt werden. Im ersten methodischen Use-Case „Phenotype pipeline“ (PheP) werden innovative datenanalytische Methoden und Werkzeuge entwickelt, welche medizinische Daten



erschließbar machen.

Mit Hilfe zweier klinischer Anwendungsfälle soll die dem Hauptziel zugrunde liegende Vorgehensweise belegt werden.

Im Use-Case ASIC (Algorithmic Surveillance of ICU Patients) werden die auf Intensivstationen anfallenden Daten kontinuierlich ausgewertet, um den Zustand der Patientinnen und Patienten automatisiert zu überwachen, um ein schnelles therapeutisches Eingreifen zu ermöglichen. Hierbei wird sich vor allem auf die Krankheit „Acute Respiratory Distress Syndrom“ (ARDS) - also akutes Lungenversagen - fokussiert. Dieses weist eine sehr hohe Mortalität auf, was vor allem auf die oftmals zu späte Erkennung der Krankheit zurückzuführen ist. Mit Hilfe der automatisierten Überwachung soll ein frühzeitiger Befund ermöglicht und folglich die Patientenbehandlung verbessert werden.

Der klinische Use-Case HELP fokussiert sich auf den zielgerichteten Einsatz von Antibiotika zur frühzeitigen Bekämpfung bakterieller Infektionen. Mit Hilfe von innovativen Technologien soll die Infektiologie auf Normal- und Intensivstationen unterstützt werden.

Die Arbeiten am Informatik 11 finden im Rahmen des Use-Cases ASIC statt. Auf dieser Basis forschen wir vor allem an der Datenplausibilität und der Klassifikation von ARDS in Sekundärdaten.

[Weitere Informationen finden Sie hier.](#)

Ansprechpartner: [Simon Fonck, M.Sc. RWTH](#), [Alexander Kruschewsky, M.Sc. RWTH](#)

Saubere Hände

Das Projekt Saubere Hände widmet sich der Erreichung von Handhygiene-Standards im medizinischen Kontext. Durch unzureichende Händedesinfektion kommt es immer wieder zu im Krankenhaus erworbenen (nosokomialen) Infektionen. Die einschlägigen Händedesinfektionsmethoden basieren in der Regel auf alkoholischen Desinfektionsmittellösungen. Während des Desinfektionsprozesses verdunstet dieser Alkohol auf der Hautoberfläche des Anwenders. Durch diese Verdunstung wird dem benetzten Hautareal Energie in Form von Wärme entzogen. Die während eines Desinfektionsprozesses entstehende Verdunstungskälte lässt sich mithilfe von Thermographie messen und aus diesen Messungen lassen sich Rückschlüsse auf Qualität der Benetzung der Hand mit Desinfektionsmittel ziehen.



Ansprechpartner: [Dr.-Ing. André Stollenwerk](#)

SmartLungControl

Im Rahmen des DFG-Projekts SmartLungControl wird ein Konzept für eine bedarfsadaptierte Steuerung und Sicherheitsüberwachung einer Langzeit-Kunsthunde außerhalb der Intensivstation erforscht. In einem ersten Schritt erfolgt eine Analyse bereits vorhandener retrospektiver Patienten- und Tierversuchsdaten, gefolgt von einer systematischen Expertenbefragung nach dem Delphi Verfahren. Im zweiten Schritt wird ein Sicherheitskonzept und ein Regelungsentwurf der Kunsthunde erarbeitet. Dazu werden u. a. auch neue Sensorkonzepte sowohl für die Zuverlässigkeitsmaßnahmen als auch für die bedarfsgerechte Adaption untersucht. Abschließend wird das entwickelte Pilotkonzept unter verschiedenen Rahmenbedingungen und in definierten kritischen Betriebszuständen in-silico, in-vitro und in-vivo im Tierversuch validiert und getestet.

Ansprechpartner: [Marc Wiartalla, M.Sc. RWTH](#)

EDIH Rheinland



Im Rahmen des EU-Projektes European Digital Innovation Hub (EDIH) Rheinland hat sich ein großes Konsortium & Netzwerk zur Aufgabe gemacht, die durch Forschungs und Industrieprojekte erworbene Kompetenz in den Bereichen Digitalisierung, Künstliche Intelligenz (KI) und High Performance Computing [kleinen und mittelständigen Unternehmen \(KMU\)](#) zur Verfügung zu stellen. In diesem Kontext möchten wir als Informatik 11 unser Wissen und unsere Erfahrungen bei der Implementierung von KI-Methoden in Form von Informationsveranstaltungen, Vorträgen oder Trainingsprogrammen vermitteln. Im Rahmen verschiedener Projekte fokussieren wir uns insbesondere die Vorverarbeitung der Daten, Datenqualität und Nutzung von State-of-the-Art KI-Modellen. Eine genaue Übersicht des Service-Portfolios befindet sich hier: [EDIH Rheinland](#) und auf der offiziellen [Webseite](#).

Ansprechpartner: [Simon Fonck, M.Sc. RWTH](#)

NANNI



Im Rahmen des vom BMBF geförderten Projektes Nanni (Neonatologiebeatmungsgerät mit adaptiver Anwenderunterstützung) haben sich die Partner Löwenstein Medical, das Universitätsklinikum Aachen und für die RWTH Aachen der Lehrstuhl Informatik 11 zusammengeschlossen. In diesem Vorhaben wird der Prototyp einer neuen Generation Früh- und Neugeborenenbeatmungsgeräte entwickelt. Auf dieser Basis forschen wir vor allem an der Regelung des arteriellen CO₂-Partialdrucks und der Erkennung von Problemen bei der künstlichen Beatmung von Neugeborenen.

Ansprechpartnerin: [Valerie Pfannschmidt, M.Sc. RWTH](#)

AutoMock



Im Rahmen des BMBF-Projekts AutoMock wird ein automatisierter Mockloop zur Langzeituntersuchung und Optimierung der Organperfusion unter verschiedensten Umständen entwickelt. Auf dieser Basis wird der Einfluss von Perfusionsparametern und pharmazeutischer Einflussnahme untersucht. Weiterhin ist der Teststand auch zum Testen von perfundierten Medizinprodukten geeignet.

[Weitere Informationen finden Sie hier.](#)

Ansprechpartner: [Marc Wiartalla, M.Sc. RWTH](#)

Team

Mitglied	Position / Projekt
Dr.-Ing. André Stollenwerk	Gruppenleiter
Lavinia Goldermann, M.Sc. RWTH	SMITH
Simon Fonck, M.Sc. RWTH	SMITH
Alexander Kruschewsky, M.Sc. RWTH	Explainable AI
Camelia Oprea, M.Sc. RWTH	Aix-Neo-Guard

Valerie Pfannschmidt, M.Sc. RWTH	NANNI
Marc Wiartalla, M.Sc. RWTH	SmartLungControl



Abschlussarbeiten

Die aktuell ausgeschriebenen Abschlussarbeiten findet Ihr hier.

Solltet ihr ein allgemeines Interesse an einer Abschlussarbeit im Bereich der Medizintechnik haben und könnt euch auf keines der genannten Themen festlegen, könnt ihr eure Bewerbung auch gerne an die gesamte Medizintechnikgruppe verschicken:

medtech-abschlussarbeiten@embedded.rwth-aachen.de

Publikationen

[BPS+24]

PDFBIB

Buglowski, M., Pfannschmidt, V., Stollenwerk, A., Schoberer, M., Huong Nguyen, T. B., Becker, S., and Braun, O., "Beatmungsgerät und Verfahren zur Atemgasversorgung", 2024.

Beatmungsgerät und Verfahren zur Atemgasversorgung

Bibtex entry :

```
@techreport { BPS+24,
  author = { Buglowski, Mateusz and Pfannschmidt, Valerie and
    Stollenwerk, André and Schoberer, Mark and Huong Nguyen,
    Thi Bich and Becker, Sabine and Braun, Oliver },
  title = { Beatmungsger{\a}t und Verfahren zur Atemgasversorgung },
  pages = { 29 Seiten : Illustrationen },
  year = { 2024 },
  typ = { PUB:(DE-HGF)23 },
  reportid = { RWTH-2024-00553 },
  cin = { 122810 / 120000537500-5 ; 537500-2 ; 933410 },
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https://worldwide.espacenet.com/patent/search/family/087245644/publication/DE102022117141A1?q=W0202408785 },
}
```

[GRB+24]

PDFBIB

Goldermann, L., Rakel, S., Buglowski, M., Mokhtarian, A., Kampmann, A., Janß, A., Yilmaz, O., Beger, F., Walter, M., Leonhardt, S., Kowalewski, S., and Stollenwerk, A., "Designing the user interface of a ventilator under the constraints of a pandemic", *Automatisierungstechnik*, vol. 72, iss. 5, pp. 484-495, 2024

Designing the user interface of a ventilator under the constraints of a pandemic

Bibtex entry :

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@article { GRB+24,
  author = { Goldermann, Lavinia and Rakel, Stefan and Buglowski,
    Mateusz
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    Armin and Yilmaz, Okan and Beger, Frank and Walter, Marian
    and Leonhardt, Steffen and Kowalewski, Stefan and
    Stollenwerk, André },
  title = { Designing the user interface of a ventilator under the
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  journal = { Automatisierungstechnik },
  publisher = { De Gruyter },
  pages = { 484-495 },
  volume = { 72 },
  number = { 5 },
  year = { 2024 },
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}
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}

[PSK24]

[PDFBIB](#)

Pfannschmidt, V., Stollenwerk, A., and Kowalewski, S., "Physiologische Regelung der künstlichen Beatmung Frühgeborener", in *Proc. Downloads zum 58. Regelungstechnischen Kolloquium vom 21. bis 23. Februar 2024: Kurzfassungen der Vorträge*, 2024.

Physiologische Regelung der künstlichen Beatmung Frühgeborener

Bibtex entry :

```
@inproceedings { PSK24,
  author = { Pfannschmidt, Valerie and Stollenwerk, André and
    Kowalewski, Stefan },
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    Frühgeborener },
  booktitle = { Downloads zum 58. Regelungstechnischen Kolloquium vom
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    https://www.iosb.fraunhofer.de/de/veranstaltungen/regelungstechnisches-
    kolloquium-boppard.html },
}
```

[BWH+23]

[PDFBIB](#)

Berg, F. J., Wiartalla, M. O., Hüllmann, M., Derks, A., Kowalewski, S., and Stollenwerk, A., "ASMO: a decentralized and verifiable interoperability platform in intensive care", *Proceedings on automation in medical engineering*, vol. 2, iss. 1, p. 2, 2023

ASMO: a decentralized and verifiable interoperability platform in intensive care

Bibtex entry :

```
@article { BWH+23,
  author = { Berg, Frederik Julius and Wiartalla, Marc Oliver and
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pages = { 2 Seiten },
volume = { 2 },
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    Automatisierungstechnische Verfahren f{"u}r die
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url = { https://doi.org/10.18416/AUTOMED.2023 },
}

```

[FFN+23]

[PDFBIB](#)

Fonck, S. A. M., Fritsch, S., Nottenkämper, G., and Stollenwerk, A., "Implementation of ResNet-50 for the Detection of ARDS in Chest X-Rays using transfer-learning", *Proceedings on automation in medical engineering*, vol. 2, iss. 1, p. 2, 2023

Implementation of ResNet-50 for the Detection of ARDS in Chest X-Rays using transfer-learning

Bibtex entry :

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@article { FFN+23,
  author = { Fonck, Simon Ansgar Martin and Fritsch, Sebastian and
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  title = { Implementation of ResNet-50 for the Detection of ARDS in
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    Automatisierungstechnische Verfahren f{"u}r die
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  doi = { 10.18154/RWTH-2023-03291 },
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  cin = { 122810 / 120000533000-3 / 931210 },
  url = { https://doi.org/10.18416/AUTOMED.2023 },
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[FLS+23]

PDFBIB

Fischbach, A., Lamberti, M., Simons, J. A., Wrede, E., Theißen, A., Winnersbach, P., Rossaint, R., Stollenwerk, A., and Bleilevens, C., "Early Blood Clot Detection Using Forward Scattering Light Measurements Is Not Superior to Delta Pressure Measurements", *Biosensors : open access journal*, vol. 13, iss. 12, p. [1]-13, 2023

Early Blood Clot Detection Using Forward Scattering Light Measurements Is Not Superior to Delta Pressure Measurements

Bibtex entry :

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@article { FLS+23,
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    künstliche implantierbare Lungen - SmartLungControl
    (447729163) },
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[WBK+23]

PDFBIB

Wartalla, M. O., Berg, F. J., Kühn, J., Buglowski, M., Bleilevens, C., Kowalewski, S., and Stollenwerk, A., "A fully automated normothermic machine perfusion system for kidney grafts supporting physiological motivated flow profiles", *Current directions in biomedical engineering*, vol. 9, iss. 1, pp. 323-326, 2023

A fully automated normothermic machine perfusion

system for kidney grafts supporting physiological motivated flow profiles

Bibtex entry :

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@article { WBK+23,
  author = { Wiartalla, Marc Oliver and Berg, Frederik Julius and
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  journal = { Current directions in biomedical engineering },
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  volume = { 9 },
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  issn = { 2364-5504 },
  organization = { 57. DGBMT Annual Conference on Biomedical
Engineering,
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  doi = { 10.1515/cdbme-2023-1081 },
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  Entwicklung eines vollautomatisierten in vitro Teststands
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[WBO+23a]

[PDFBIB](#)

Wiartalla, M. O., Berg, F. J., Ottersbach, F., Kühn, J., Buglowski, M., Kowalewski, S., and Stollenwerk, A., "A modular and verifiable software architecture for interconnected medical systems in intensive care", *Annals of computer science and information systems*, vol. 37, pp. 345-351, 2023

A modular and verifiable software architecture for interconnected medical systems in intensive care

Bibtex entry :

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@article { WB0+23a,
  author = { Wiartalla, Marc Oliver and Berg, Frederik Julius and
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    interconnected medical systems in intensive care },
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[BOP+22]

[PDFBIB](#)

Becker, S., Olivier, L., Pfannschmidt, V., Buglowski, M., Hütten, M., Wienhold, M., Orlikowsky, T., Stollenwerk, A., and Schoberer, M., "Closed-Loop Kontrolle des endtidalen CO₂ im Frühgeborenen Lämmer-Modell", in *Proc. Abstracts 48. Jahrestagung der Gesellschaft für Neonatologie und Pädiatrische Intensivmedizin / Gesellschaft für Neonatologie und Pädiatrische Intensivmedizin e. V. = 1, 1, 1, Jena : Conventus Congressmanagement & Marketing GmbH, 2022., Jena, 2022, Conventus Congressmanagement & Marketing GmbH, p. 92.*

Closed-Loop Kontrolle des endtidalen CO₂ im Frühgeborenen Lämmer-Modell

Bibtex entry :

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@inproceedings { BOP+22,
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    Wienhold, Marie and Orlikowsky, Thorsten and Stollenwerk,
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    Fr{"u}hgeborenen L{"a}mmer-Modell },
    booktitle = { Abstracts 48. Jahrestagung der Gesellschaft f{"u}r
    Neonatologie und P{"a}diatrische Intensivmedizin /
    Gesellschaft f{"u}r Neonatologie und P{"a}diatrische
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    mit adaptiver Anwenderunterst{"u}tzung (NANNI) -
    Teilvorhaben: Erforschung neuer Modelle zur Diagnose von
    Fehlerzust{"a}nden (BMBF-13GW0292C) },
}

```

[BPB+22]

[PDFBIB](#)

Buglowski, M., Pfannschmidt, V., Becker, S., Braun, O., Hutten, M., Ophelders, D., Oprea, C., Pattai, S., Schoberer, M., and Stollenwerk, A., "Closed-Loop Control of Arterial CO2 in Mechanical Ventilation of Neonates", in *Proc. 44th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) / pre-conference workshops & social events: Monday, July 11, 2022, conference dates: Tuesday, July 12-Friday, July 15, 2022 / conference chair: Christopher James (University of Warwick), conference co-chair: James Patton (University of Chicago) ; programm chair: Ron Summers (Collegium Basilea), [Piscataway, NJ], 2022, IEEE, pp. 4991-4995.*

Closed-Loop Control of Arterial CO2 in Mechanical Ventilation of Neonates

Bibtex entry :

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@inproceedings { BPB+22,
    author = { Buglowski, Mateusz and Pfannschmidt, Valerie and Becker,
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Mark and Stollenwerk, André },
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Engineering
in Medicine and Biology Society (EMBC) / pre-conference
workshops & social events: Monday, July 11, 2022, conference
dates: Tuesday, July 12-Friday, July 15, 2022 / conference
chair: Christopher James (University of Warwick), conference
co-chair: James Patton (University of Chicago) ; programm
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mit adaptiver Anwenderunterst{\u}tzung (NANNI) -
Teilvorhaben: Erforschung neuer Modelle zur Diagnose von
Fehlerzust{\a}nden (BMBF-13GW0292C) },
}

```

[JSS+22]

[PDFBIB](#)

Janisch, T., Stollenwerk, A., Siekmann, U., and Kopp, R., "Treatment of children with Hyperbaric Oxygenation (HBOT) : an Europe-wide survey", *Minerva pediatrics*, vol. 74, iss. 2, pp. 116-120, 2022

Treatment of children with Hyperbaric Oxygenation (HBOT) : an Europe-wide survey

Bibtex entry :

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@article { JSS+22,
author = { Janisch, Thorsten and Stollenwerk, André and Siekmann,
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[OBS+22]

[PDFBIB](#)

Olivier, L., Buglowski, M., Sabine, B., Hütten, M., Olikowsky, T., Stollenwerk, A., and Schoberer, M., "Work in progress: Detektion einer intensivierten invasiven Beatmung bei Neonaten mithilfe eines Fuzzylogik-Modells", in *Proc. Abstracts 48. Jahrestagung der Gesellschaft für Neonatologie und Pädiatrische Intensivmedizin / Gesellschaft für Neonatologie und Pädiatrische Intensivmedizin e. V.*, Jena, 2022, Conventus Congressmanagement & Marketing GmbH, p. 93.

Work in progress: Detektion einer intensivierten invasiven Beatmung bei Neonaten mithilfe eines Fuzzylogik-Modells

Bibtex entry :

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@inproceedings { OBS+22,
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[WSE+22]

[PDFBIB](#)

Walter, M., Stollenwerk, A., Eckstein, L., Kowalewski, S., and Leonhardt, S., "PV1000 - Interdisziplinäre Entwicklung eines Pandemie-Beatmungsgerätes", in *Proc. MT-2022 Tagungsband*, 2022, p. 169.

PV1000 - Interdisziplinäre Entwicklung eines Pandemie-Beatmungsgerätes

Bibtex entry :

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@inproceedings { WSE+22,
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https://www.vdi-mechatroniktagung.de/images/programm/MT2022_Tagungsband
.pdf },
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[FFK+21]

[PDFBIB](#)

Fonck, S., Fritsch, S. J., Kowalewski, S., Hensen, R., and Stollenwerk, A., "Algorithmic distinction of ARDS and Heart Failure in ICU data from medical embedded systems by using a computer model", *IFAC-PapersOnLine*, vol. 54, iss. 4, pp. 135-140, 2021

Algorithmic distinction of ARDS and Heart Failure in ICU

data from medical embedded systems by using a computer model

Bibtex entry :

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@article { FFK+21,
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[LKL+21]

[PDFBIB](#)

Lamberti, M., Kopp, R., Lübke, C., Leonhardt, S., Walter, M., and Stollenwerk, A., "Safety and Automation Concepts for Artificial Impantable Lungs - SmartLungControl", *Biomedical engineering*, vol. 66, iss. s1, 2021

Safety and Automation Concepts for Artificial Impantable Lungs - SmartLungControl

Bibtex entry :

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@article { LKL+21,
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[MBF+21]

[PDFBIB](#)

Marx, G., Bickenbach, J., Fritsch, S. J., Kunze, J. B., Maassen, O., Deffge, S., Kistermann, J., Haferkamp, S. D., Lutz, I., Voellm, N. K., Lowitsch, V., Polzin, R., Sharafutdinov, K., Mayer, H., Kuepfer, L., Burghaus, R., Schmitt, W., Lippert, J., Riedel, M., Barakat, C., Stollenwerk, A., Fonck, S., Putensen, C., Zenker, S., Erdfelder, F., Grigutsch, D., Kram, R., Beyer, S., Kampe, K., Gewehr, J. E., Salman, F., Juers, P., Kluge, S., Tiller, D., Wisotzki, E., Gross, S., Homeister, L., Bloos, F., Scherag, A., Ammon, D., Mueller, S., Palm, J., Simon, P., Jahn, N., Loeffler, M., Wendt, T., Schuerholz, T., Groeber, P., and Schuppert, A., "Algorithmic surveillance of ICU patients with acute respiratory distress syndrome (ASIC) : protocol for a multicentre stepped-wedge cluster randomised quality improvement strategy", *BMJ open*, vol. 11, iss. 4, pp. 1-7, 2021

Algorithmic surveillance of ICU patients with acute respiratory distress syndrome (ASIC) : protocol for a multicentre stepped-wedge cluster randomised quality improvement strategy

Bibtex entry :

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@article { MBF+21,
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Sebastian
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Dorothee and Lutz, Irina and Voellm, Nora Kristiana and
Lowitsch, Volker and Polzin, Richard and Sharafutdinov,
Konstantin and Mayer, Hannah and Kuepfer, Lars and Burghaus,
Rolf and Schmitt, Walter and Lippert, Joerg and Riedel,
Morris and Barakat, Chadi and Stollenwerk, André and Fonck,
Simon and Putensen, Christian and Zenker, Sven and
Erdfelder, Felix and Grigutsch, Daniel and Kram, Rainer and

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Beyer, Susanne and Kampe, Knut and Gewehr, Jan Erik and
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[PSS+21]

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Preuss, R., Smieschek, M., Stollenwerk, A., Kowalewski, S., and Heinrichs, T.,
 "Behälterreinigungsmaschine", 2021.

Behälterreinigungsmaschine

Bibtex entry :

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@techreport { PSS+21,
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Stollenwerk,
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}

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}

[BBF+20]

[PDFBIB](#)

Buglowski, M., Bleilevens, C., Fabry, G., Kowalewski, S., and Stollenwerk, A., "Flussgesteuerte pH-Regulierung in einem automatisierten Nierenperfusionssystem", *Proceedings on automation in medical engineering*, vol. 1, iss. 1, 2020

Flussgesteuerte pH-Regulierung in einem automatisierten Nierenperfusionssystem

Bibtex entry :

```
@article { BBF+20,
  author = { Buglowski, Mateusz and Bleilevens, Christian and Fabry,
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    Entwicklung eines vollautomatisierten in vitro Teststands
    (Mock Loop) - Ein k{"u}nstlicher Kreislauf als
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[KGE+20]

[PDFBIB](#)

König, G., Grochowski, M., Eckert, M., Jakobczak, F., Stollenwerk, J., Kowalewski, S., and Loosen, P., "Apparat zur automatisierten Justage optischer Systeme", *DGaO-Proceedings*, vol. 2020, 2020

Apparat zur automatisierten Justage optischer Systeme

Bibtex entry :

```
@article { KGE+20,
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[SRT+20]

[PDFBIB](#)

Smieschek, M., Rakel, S., Thönnessen, D., Derks, A., Stollenwerk, A., and Kowalewski, S., "A Remote Test Environment for a Large-Scale Microcontroller Laboratory Course", in *Proc. Cyber physical systems : model-based design : 9th international workshop, CyPhy 2019 and 15th international workshop, WESE 2019, New York City, NY, USA, October 17-18, 2019 : revised selected papers / Roger Chamberlain, Martin Edin Grimheden, Walid Taha (eds.)*, Cham, 2020 in *Lecture Notes in Computer Science*, Springer, pp. 231-246.

A Remote Test Environment for a Large-Scale Microcontroller Laboratory Course

Bibtex entry :

```
@inproceedings { SRT+20,
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    Edin Grimheden, Walid Taha (eds.) },
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Systems
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Final.pdf },
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[SS20]

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Stollenwerk, A. and Smieschek, M., "Eingabe und Übertragung von Instandhaltungsinformationen für das Condition Monitoring - Digitalisierung von Offline-Informationen", , Düsseldorf / Berlin, VDI/VDE 3711, 2020.

Eingabe und Übertragung von Instandhaltungsinformationen für das Condition Monitoring - Digitalisierung von Offline-Informationen

Bibtex entry :

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@techreport { SS20,
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Demonstratoren in realen Umgebungen und Evaluation mit Fokus
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[Sto20]

[PDFBIB](#)

Stollenwerk, A., "An Embedded Graduate Lab Course with Spirit", in *Proc. Cyber physical systems : model-based design : 9th international workshop, CyPhy 2019 and 15th international workshop, WESE 2019, New York City, NY, USA, October 17-18, 2019 : revised selected papers / Roger Chamberlain, Martin Edin Grimheden, Walid Taha (eds.)*, Cham, 2020 in *Lecture Notes in Computer Science*, Springer, pp. 247-263.

An Embedded Graduate Lab Course with Spirit

Bibtex entry :

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@inproceedings { Sto20,
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[FDG+19]

[PDFBIB](#)

Fabry, G., Doorschodt, B. M., Grzanna, T., Boor, P., Elliott, A. R., Stollenwerk, A., Tolba, R. H., Rossaint, R., and Bleilevens, C., "Cold Preflush of Porcine Kidney Grafts Prior to Normothermic Machine Perfusion Aggravates Ischemia Reperfusion Injury", *Scientific reports*, vol. 9, p. 9, 2019

Cold Preflush of Porcine Kidney Grafts Prior to Normothermic Machine Perfusion Aggravates Ischemia Reperfusion Injury

Bibtex entry :

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@article { FDG+19,
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[KBS+19]

[PDFBIB](#)

Kühn, J., Buglowski, M., Stollenwerk, A., Kowalewski, S., Walter, M., Leonhardt, S., Petran, J., Kopp, R., Rossaint, R., and Janisch, T., "Fault Identification in a Blood Pump Using Neural Networks", in *Proc. World Congress on Medical Physics and Biomedical Engineering 2018 : June 3-8, 2018, Prague, Czech Republic (Vol.2) / edited by Lenka Lhotska, Lucie Sukupova, Igor Lacković, Geoffrey S. Ibbott*, Singapore, 2019 in IFMBE Proceedings, Springer Singapore, pp. 27-32.

Fault Identification in a Blood Pump Using Neural Networks

Bibtex entry :

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@inproceedings { KBS+19,
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[PAS+19]

[PDFBIB](#)

Pomprapa, A., Ahmed, W., Stollenwerk, A., Kowalewski, S., and Leonhardt, S., "Deep Learning of Arrhythmia Analysis Based on Convolutional Neural Network", *International journal of bioelectromagnetism : IJBEM*, vol. 21, iss. 1, pp. 48-58, 2019

Deep Learning of Arrhythmia Analysis Based on Convolutional Neural Network

Bibtex entry :

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@article { PAS+19,
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[SKS+19]

[PDFBIB](#)

Smieschek, M., Kobsik, G., Stollenwerk, A., Kowalewski, S., Orlikowsky, T., and Schoberer, M., "Aided Hand Detection in Thermal Imaging Using RGB Stereo Vision", in *Proc. Biomedical engineering ranging from wellness to intensive care : 2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) : 41st EMB Conference : July 23-27, Berlin / IEEE, EMB ; conference editorial board chair: Riccardo Barbieri, Milan, Italy, Piscataway, NJ, 2019, IEEE, pp. 6314-6317.*

Aided Hand Detection in Thermal Imaging Using RGB Stereo Vision

Bibtex entry :

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@inproceedings { SKS+19,
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[KSK+18]

[PDFBIB](#)

Kühn, J., Stollenwerk, A., Kowalewski, S., Fabry, G., Grzanna, T., Doorschodt, B., Tolba, R. H., Rossaint, R., and Bleilevens, C., "A long-term setup for kidney perfusion." 2018.

A long-term setup for kidney perfusion

Bibtex entry :

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@inproceedings { KSK+18,
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-
Entwicklung eines vollautomatisierten in vitro Teststands
(Mock Loop) - Ein k{"u"}nstlicher Kreislauf als
Ersatzmethode zur Biokompatibilit  tstestung von
Membranoxygenatoren und zur Transplantationssimulation
(BMBF-031L0134B) },

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[PAS+18]

PDFBIB

Pomprapa, A., Ahmed, W., Stollenwerk, A., Kowalewski, S., Uguz, D. U., and Leonhardt, S., "Arrhythmia Analysis in a Non-contact cECG Chair using Convolutional Neural Network", in *Proc. Proceedings of the 11th International Conference on Bioelectromagnetism : 23-25 May 2018, Aachen, Germany / Organizing Committee for ICBEM 2018 in Aachen: Prof. Steffen Leonhardt, RWTH Aachen University, Germany, Prof. Jaakko Malmivuo, Technische Universität Berlin, Germany, Dr. Marian Walter, RWTH Aachen University, Germany, Benjamin Hentze, RWTH Aachen University, Germany Markus Lüken, RWTH Aachen University, Germany ; Scientific Committee for ICBEM 2018 in Aachen: Prof. Catherine Disselhorst-Klug, RWTH Aachen University, Germany [und 27 weitere], Aachen, 2018, p. 4.*

Arrhythmia Analysis in a Non-contact cECG Chair using Convolutional Neural Network

Bibtex entry :

```
@inproceedings { PAS+18,
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      Malmivuo, Technische Universit{"a"}t Berlin, Germany, Dr.
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[PAS+18a]

[PDFBIB](#)

Pomprapa, A., Ahmed, W., Sayani, M. S., Stollenwerk, A., Kowalewski, S., and Leonhardt, S., "Classification of Obstructive Sleep Apnea Using Machine Learning", *American journal of respiratory and critical care medicine*, vol. 197, iss. Abstract Issue, p. 1, 2018

Classification of Obstructive Sleep Apnea Using Machine Learning

Bibtex entry :

```
@article { PAS+18a,
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[PAS+18b]

[PDFBIB](#)

Pomprapa, A., Ahmed, W., Stollenwerk, A., Kowalewski, S., Uguz, D. U., and Leonhardt, S., "Arrhythmia Analysis in a Non-contact cECG Chair using Convolutional Neural Network", *International journal of bioelectromagnetism : IJBEM*, vol. 20, iss. 1, pp. 47-50, 2018

Arrhythmia Analysis in a Non-contact cECG Chair using Convolutional Neural Network

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@article { PAS+18b,
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[PSA+18]

[PDFBIB](#)

Pomprapa, A., Sayani, M. S., Anwar, T., Stollenwerk, A., Kowalewski, S., von Platen, P. H., and Leonhardt, S., "Apnea Detection in a Contactless Multisensor System using Deep Learning Algorithm", in *Proc. [13th Russian-German Conference on Biomedical Engineering (RGC), RGC, 2018-05-23 - 2018-05-25, Aachen, Germany]*, 2018.

Apnea Detection in a Contactless Multisensor System using Deep Learning Algorithm

Bibtex entry :

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@inproceedings { PSA+18,
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[SBK18]

[PDFBIB](#)

Stollenwerk, A., Buglowski, M., and Kühn, J., "Mock loop for bubble generation in a centrifugal blood pump for fault simulation", *Current Directions in Biomedical Engineering*, vol. 4, iss. 1, pp. 33-36, 2018

Mock loop for bubble generation in a centrifugal blood pump for fault simulation

Bibtex entry :

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@article { SBK18,
  author = { Stollenwerk, André and Buglowski, Mateusz and K{"u}hn,
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```

[SHS+18]

[PDFBIB](#)

Smieschek, M., Hinrichs, T., Stollenwerk, A., Kowalewski, S., and Preuß, R., "A New Condition Indicator for Slow-Rotating Roller Chains based on the Angle and Torque of the Driving Motor", in *Proc. 2018 IEEE 14th International Conference on Automation Science and Engineering (CASE) : 20-24 Aug. 2018 / general chair: Birgit Vogel-Heuser (Technical University of Munich) ; publisher: IEEE, Piscataway, NJ, 2018, IEEE, pp. 642-644.*

A New Condition Indicator for Slow-Rotating Roller Chains based on the Angle and Torque of the Driving Motor

Bibtex entry :

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@inproceedings { SHS+18,
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[WSA+18]

[PDFBIB](#)

Winter, A., Stäubert, S., Ammon, D., Aiche, S., Beyan, O. D., Bischoff, V., Daumke, P., Decker, S. J., Funkat, G., Gewehr, J. E., de Greiff, A., Haferkamp, S. D., Hahn, U., Henkel, A., Kirsten, T., Klöss, T., Lippert, J., Löbe, M., Lowitsch, V., Maassen, O., Maschmann, J., Meister, S., Mikolajczyk, R., Nüchter, M., Pletz, M. W., Rahm, E., Riedel, M., Saleh, K., Schuppert, A., Smers, S., Stollenwerk, A., Uhlig, S., Wendt, T., Zenker, S., Fleig, W., Marx, G., Scherag, A., and Löffler, M., "Smart Medical Information Technology for Healthcare (SMITH) : Data Integration based on Interoperability Standards", *Methods of information in medicine*, vol. 57, iss. S 01, p. e92-e105, 2018

Smart Medical Information Technology for Healthcare

(SMITH) : Data Integration based on Interoperability Standards

Bibtex entry :

```
@article { WSA+18,
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[BHK+17]

[PDFBIB](#)

Brendle, C., Hackmack, K. -F., Kühn, J., Wardeh, M. N., Janisch, T., Kopp, R., Rossaint, R., Stollenwerk, A., Kowalewski, S., Leonhardt, S., Walter, M., and Misgeld, B. J. E., "Closed-loop control of extracorporeal oxygen and carbon dioxide gas transfer", *Control engineering practice*, vol. 59, pp. 173-182, 2017

Closed-loop control of extracorporeal oxygen and carbon dioxide gas transfer

Bibtex entry :

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@article { BHK+17,
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[BMK+17]

[PDFBIB](#)

Brendle, C., Mülders, T., Kühn, J., Janisch, T., Kopp, R., Rossaint, R., Stollenwerk, A., Kowalewski, S., Misgeld, B. J. E., Leonhardt, S., and Walter, M., "Physiological closed-loop control of mechanical ventilation and extracorporeal membrane oxygenation", *Biomedical engineering = Biomedizinische Technik*, vol. 62, iss. 2, pp. 199-212, 2017

Physiological closed-loop control of mechanical ventilation and extracorporeal membrane oxygenation

Bibtex entry :

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[KBS+17]

[PDFBIB](#)

Kühn, J., Brendle, C., Stollenwerk, A., Schweigler, M., Kowalewski, S., Janisch, T., Rossaint, R., Leonhardt, S., Walter, M., and Kopp, R., "Decentralized safety concept for closed-loop controlled intensive care : Supervision of a blood pump during extracorporeal circulation", *Biomedical engineering = Biomedizinische Technik*, vol. 62, iss. 2, pp. 213-224, 2017

Decentralized safety concept for closed-loop controlled intensive care : Supervision of a blood pump during extracorporeal circulation

Bibtex entry :

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@article { KBS+17,
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[SKS+17]

[PDFBIB](#)

Stollenwerk, A., Kopp, R., Sehl, F., and Janisch, T., "Tauchcomputerunterstützung durch vernetzte Smart Wearables", *Caisson : Mitteilungen der GTÜM e.V.*, vol. 32, iss. 4, 2017

Tauchcomputerunterstützung durch vernetzte Smart Wearables

Bibtex entry :

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@article { SKS+17,
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[SSK+17]

[PDFBIB](#)

Smieschek, M., Stollenwerk, A., Kowalewski, S., Orlikowsky, T., and Schoberer, M., "Unterstützte Handerkennung in Thermographiebildern zur Validierung der hygienischen Händedesinfektion", in *Proc. Bildverarbeitung für die Medizin 2017 : Algorithmen - Systeme - Anwendungen : Proceedings des Workshops vom 12. bis 14. März 2017 in Heidelberg / Klaus Hermann Maier-Hein, Thomas M. Deserno, Heinz Handels, Thomas Tolxdorff (Herausgeber)*, Berlin, Heidelberg, 2017 in Informatik aktuell, Springer Berlin Heidelberg, pp. 147-152.

Unterstützte Handerkennung in Thermographiebildern zur Validierung der hygienischen Händedesinfektion

Bibtex entry :

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@inproceedings { SSK+17,

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Algorithmen -
Systeme - Anwendungen : Proceedings des Workshops vom 12.
bis 14. M{\a}rz 2017 in Heidelberg / Klaus Hermann
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series = { Informatik aktuell },
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[SSM+17]

[PDFBIB](#)

Stollenwerk, A., Sehl, F., Marx, G., Kowalewski, S., and Janisch, T., "Enrichment of a diving computer with body sensor network data", in *Proc. 2017 IEEE 14th International Conference on Wearable and Implantable Body Sensor Networks (BSN) : 9-12 May 2017 / sponsors: IEEE, EMB*, Piscataway, NJ, 2017, IEEE, pp. 169-172.

Enrichment of a diving computer with body sensor network data

Bibtex entry :

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@inproceedings { SSM+17,
author = { Stollenwerk, André and Sehl, Florian and Marx, Gernot
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title = { Enrichment of a diving computer with body sensor network
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booktitle = { 2017 IEEE 14th International Conference on Wearable
and
Implantable Body Sensor Networks (BSN) : 9-12 May 2017 /
sponsors: IEEE, EMB },

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publisher = { IEEE },
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[BHK+16]

[PDFBIB](#)

Brendle, C., Hackmack, K. -F., Kühn, J., Wardeh, M. N., Janisch, T., Kopp, R., Rossaint, R., Stollenwerk, A., Kowalewski, S., Misgeld, B. J. E., Leonhardt, S., and Walter, M., "Continuous gas transfer monitoring during extracorporeal membrane oxygenation", *Biomedical signal processing and control*, vol. 31, pp. 321-330, 2016

Continuous gas transfer monitoring during extracorporeal membrane oxygenation

Bibtex entry :

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@article { BHK+16,
  author = { Brendle, Christian and Hackmack, K.-F. and K{"u"}hn, Jan
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[KBS+16]

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Kopp, R., Bensberg, R., Stollenwerk, A., Arens, J., Grottke, O., Walter, M., and Rossaint, R., "Automatic Control of Veno-Venous Extracorporeal Lung Assist : Presented in part at the 13th Congress of DIVI held December 4-6, 2013 in Leipzig, Germany", *Artificial organs*, vol. 40, iss. 10, pp. 992-998, 2016

Automatic Control of Veno-Venous Extracorporeal Lung Assist : Presented in part at the 13th Congress of DIVI held December 4-6, 2013 in Leipzig, Germany

Bibtex entry :

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[KSB+16]

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Kühn, J., Stollenwerk, A., Brendle, C., Janisch, T., Walter, M., Rossaint, R., Leonhardt, S., Kowalewski, S., and Kopp, R., "Sensor Supervision and Control Value Limitations in Networked Intensive Care", in *Proc. [Gemeinsamer Tagungsband der Workshops der Tagung Software Engineering 2016 (SE-WS 2016), Wien, 23.-26. Februar 2016 / Edited by: Wolf Zimmermann, Lukas Alperowitz, Bernd Brügge, Jörn Fahsel, Andrea Herrmann, Anne Hoffmann, Andreas Krall, Dieter Landes, Horst Lichter, Dirk Riehle, Ina Schaefer, Constantin Scheuermann, Alexander Schlaefer, Sibylle Schupp, Andreas Seitz, Andreas Steffens, André Stollenwerk, Rüdiger Weißbach]*, Aachen, Germany, 2016 in CEUR Workshop Proceedings, RWTH Aachen, pp. 187-194.

Sensor Supervision and Control Value Limitations in Networked Intensive Care

Bibtex entry :

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@inproceedings { KSB+16,
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[KVS+16]

[PDFBIB](#)

K hn, J., Vaitl, L., Stollenwerk, A., Brendle, C., Walter, M., Leonhardt, S., Kowalewski, S., Rossaint, R., Kopp, R., and Janisch, T., "Eingebettete Rezirkulationsmessung f r eine ECLA-Therapie", in *Proc. AUTOMED 2016 : Workshop : Wismar, 22.-23. September 2016 / DGBMT - Deutsche Gesellschaft f r Biomedizinische Technik im VDE ; Editoren: Prof. Dr.-Ing. habil. Olaf Simanski, Dr. Olaf Hagendorf, J rg Zucknik*, Wismar, 2016, Hochschule Wismar, Fakult t f r Ingenieurwissenschaften, Fachgebiet Automatisierungstechnik/Mechatronik, p. 2.

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@inproceedings { KVS+16,
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[SSJ+16]

PDFBIB

Smieschek, M., Stollenwerk, A., Jüptner, J. P., Kowalewski, S., Orlikowsky, T., and Schoberer, M., "Evaluating Hand Disinfection with Alcohol-Based Hand Sanitizers Using Thermal Imaging", in *Proc. [Gemeinsamer Tagungsband der Workshops der Tagung Software Engineering 2016 (SE-WS 2016), Wien, 23.-26. Februar 2016 / Edited by: Wolf Zimmermann, Lukas Alperowitz, Bernd Brügge, Jörn Fahsel, Andrea Herrmann, Anne Hoffmann, Andreas Krall, Dieter Landes, Horst Lichter, Dirk Riehle, Ina Schaefer, Constantin Scheuermann, Alexander Schlaefer, Sibylle Schupp, Andreas Seitz, Andreas Steffens, André Stollenwerk, Rüdiger Weißbach]*, Aachen, Germany, 2016 in CEUR Workshop Proceedings, RWTH Aachen, pp. 174-181.

Evaluating Hand Disinfection with Alcohol-Based Hand Sanitizers Using Thermal Imaging

Bibtex entry :

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@inproceedings { SSJ+16,
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[SSS16]

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Schlaefer, A., Schupp, S., and Stollenwerk, A., "FS-MCPS: 2nd Workshop on Fail Safety in Medical Cyber-Physical Systems", in *Proc. Software Engineering 2016 : 23. - 26. Februar 2016, Wien, Österreich / Jens Knoop ; Uwe Zdun (Hrsg.)*, Bonn, 2016 in GI-Edition : lecture notes in informatics, Gesellschaft für Informatik, pp. 127-128.

FS-MCPS: 2nd Workshop on Fail Safety in Medical Cyber-Physical Systems

Bibtex entry :

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@inproceedings { SSS16,
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[SSS16a]

[PDFBIB](#)

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2nd Workshop on Fail Safety in Medical Cyber-Physical Systems (FS-MCPS)

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@inproceedings { SSS16a,
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[WBK+16]

[PDFBIB](#)

Walter, M., Brendle, C., Kühn, J., Janisch, T., Kopp, R., Stollenwerk, A., and Leonhardt, S., "Assistive Control of Extracorporeal Oxygenation Systems", in *Proc. Proceedings of the 12th Russian-German Conference on Biomedical Engineering : 04-07 Jul 2016, Suzdal, Russia*, Suzdal, 2016, Vladimir state univ. named after Alexandr and Nikolay Stoletovs, pp. 222-226.

Assistive Control of Extracorporeal Oxygenation Systems

Bibtex entry :

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@inproceedings { WBK+16,
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[ZAB+16]

[PDFBIB](#)

Zimmermann, W., Alperowitz, L., Brügge, B., Fahsel, J., Herrmann, A., Hoffmann, A., Krall, A., Landes, D., Lichter, H., Riehle, D., Schaefer, I., Scheuermann, C., Schlaefer, A., Schupp, S., Seitz, A., Steffens, A., Stollenwerk, A., and Weißbach, R., Eds., *Gemeinsamer Tagungsband der Workshops der Tagung Software Engineering 2016 (SE-WS 2016)*, Wien, 23.-26. Februar 2016, Aachen, Germany: RWTH Aachen, 2016.

Gemeinsamer Tagungsband der Workshops der Tagung Software Engineering 2016 (SE-WS 2016), Wien, 23.-26. Februar 2016

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[BHK+15]

[PDFBIB](#)

Brendle, C., Hackmack, K., Kühn, J., Wardeh, M. N., Kopp, R., Rossaint, R., Stollenwerk, A., Kowalewski, S., Misgeld, B. J. E., Leonhardt, S., and Walter, M., "In silico evaluation of gas transfer estimation during extracorporeal membrane oxygenation", *IFAC-PapersOnLine*, vol. 48, iss. 20, pp. 499-504, 2015

In silico evaluation of gas transfer estimation during extracorporeal membrane oxygenation

Bibtex entry :

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@article { BHK+15,
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[dMK+15]

[PDFBIB](#)

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Bibtex entry :

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@article { dMK+15,
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[KSB+15]

[PDFBIB](#)

Kühn, J., Stollenwerk, A., Brendle, C., Walter, M., Wardeh, M. N., Kopp, R., and Kowalewski, S., "Embedded Safety Measures for Extracorporeal Blood Circulation", in *Proc. [Proceedings of the 11th German-Russian-Conference on Biomedical Engineering, GRC, 17.06.2015-19.06.2015, Aachen, Germany]*, 2015, pp. 169-170.

Embedded Safety Measures for Extracorporeal Blood Circulation

Bibtex entry :

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[KSK+15]

[PDFBIB](#)

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Bibtex entry :

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@article { KSK+15,
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[KSS+15]

[PDFBIB](#)

Kühn, J., Schoonbrood, P., Stollenwerk, A., Brendle, C., Wardeh, M. N., Walter, M., Roissant, R., Leonhardt, S., Kowalewski, S., and Kopp, R., "Safety Conflict Analysis in Medical Cyber-Physical Systems Using an SMT-Solver", in *Proc. SE-WS 2015, software engineering workshops 2015 : gemeinsamer Tagungsband der Workshops der Tagung Software Engineering 2015, Dresden, 17. - 18. März 2015 / hrsg. von Wolg Zimmermann ...*, Aachen, Germany, 2015 in CEUR workshop proceedings, RWTH Aachen, pp. 19-23.

Safety Conflict Analysis in Medical Cyber-Physical Systems Using an SMT-Solver

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  author = { K{"u}hn, Jan and Schoonbrood, Pierre and Stollenwerk,
    André and Brendle, Christian and Wardeh, Markus Nabil and
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[KWS+15]

[PDFBIB](#)

Kühn, J., Wübbels, N., Stollenwerk, A., Kowalewski, S., Brendle, C., Walter, M., Leonhardt, S., Wardeh, M., Kopp, R., and Roissant, R., "Pulsatile Ansteuerung einer Diagonalblutpumpe", in *Proc. Automation 2015 : 16. Branchentreff der Mess- und Automatisierungstechnik, 11. und 12. Juni 2015, Baden-Baden / VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik*, Düsseldorf, 2015 in VDI-Berichte, VDI-Verl., pp. 325-339.

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@inproceedings { KWS+15,
  author = { K{"u}hn, Jan and W{"u"}bbels, Nico and Stollenwerk,
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[SKW+15]

[PDFBIB](#)

Stollenwerk, A., Kühn, J., Walter, M., Brendle, C., Wardeh, M. N., Rossaint, R., Leonhardt, S., Kowalewski, S., and Kopp, R., "Software-based Prediction of Cannula Occlusion during Extracorporeal Blood Circulation through Networked Medical Data", in *Proc. SE-WS 2015, software engineering workshops 2015 : gemeinsamer Tagungsband der Workshops der Tagung Software Engineering 2015, Dresden, 17. - 18. März 2015 / hrsg. von Wolg Zimmermann ...*, Aachen, Germany, 2015 in CEUR workshop proceedings, RWTH Aachen, pp. 1-6.

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Bibtex entry :

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@inproceedings { SKW+15,
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[SLR+15]

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Bibtex entry :

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@inproceedings { SLR+15,
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[SKB+14]

[PDFBIB](#)

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Bibtex entry :

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[PMS+13]

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url = {
http://publications.rwth-aachen.de/record/231825/files/231825.pdf },
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[Sto13]

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Bibtex entry :

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@phdthesis { Sto13,
  author = { Stollenwerk, André },
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[WBS+13]

[PDFBIB](#)

Walter, M., Brendle, C., Stollenwerk, A., Kopp, R., Arens, J., Bensberg, R., and Leonhardt, S., "Patient oriented closed loop control of extracorporeal lung assist", in *Proc. Journal of critical care*, New York, NY, 2013, vol. 28, Elsevier, p. e8-e9.

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Bibtex entry :

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  author = { Walter, Marian and Brendle, Christian and Stollenwerk,
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[WSB+13]

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@article { WBS+13,
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[KRS12]

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Kowalewski, S., Rumpe, B., and Stollenwerk, A., "Cyber-Physical Systems - eine Herausforderung an die Automatisierungstechnik?", in *Proc. Automation 2012 : der 13. Branchentreff der Mess- und Automatisierungstechnik / VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik ; Kongress 'Automation 2012' ; 13 (Baden-Baden) ; 2011.06.13-14 Branchentreff der Mess- und Automatisierungstechnik*, Düsseldorf, 2012 in VDI-Berichte, VDI-Verl., pp. 113-116.

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Bibtex entry :

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  author = { Kowalewski, Stefan and Rumpe, Bernhard and Stollenwerk,
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[WBB+12]

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Closed loop physiological ECMO control

Bibtex entry :

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@inproceedings { WBB+12,
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[WBS+12]

[PDF](#)BIB

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Bibtex entry :

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@inproceedings { WBS+12,
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http://www.scai-med.org/meetings/2012Iccai/2012iccaiprogram.pdf },
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[BBS+11]

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Beckschulze, E., Brauer, J., Stollenwerk, A., and Kowalewski, S., "Analyzing Embedded Systems Code for Mixed-Critical Systems Using Hybrid Memory Representations", in *Proc. 2011 14th IEEE International Symposium on Object/Component/Service-Oriented Real-Time Distributed Computing workshops (ISORCW) : 28 - 31 March 2011, Newport Beach, California, USA ; proceedings*, Piscataway, NJ, 2011, IEEE, pp. 33-40.

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Bibtex entry :

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@inproceedings { BBS+11,
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[BBS+11a]

[PDFBIB](#)

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Bibtex entry :

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@article { BBS+11a,
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[BBS+11b]

[PDFBIB](#)

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[KBW+11]

[PDFBIB](#)

Kopp, R., Bensberg, R., Walter, M., Arens, J., Rossaint, R., and Stollenwerk, A., "Automation of extracorporeal membrane oxygenation using a combined safety and control concept", in *Proc. Intensive care medicine*, Berlin [u.a.], 2011, vol. 37, Springer, pp. 230-230.

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Bibtex entry :

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[KS11]

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@conference { KS11,  
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[SGA+11]

PDFBIB

Stollenwerk, A., Gathmann, F., Arens, J., Bensberg, R., Walter, M., Kopp, R., and Kowalewski, S., "Safety Aware Pump-Control for a Rotary ECMO Blood Pump", in *Proc. The international journal of artificial organs*, Milano [u.a.], 2011, vol. 34, Wichtig, pp. 617-617.

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Bibtex entry :

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@inproceedings { SGA+11,  
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[SGB+11]

PDFBIB

Stollenwerk, A., Gathmann, F., Bensberg, R., Walter, M., Arens, J., Kopp, R., and Kowalewski, S., "A model-based safety concept for a rotary blood pump", *Biomedizinische Technik = Biomedical engineering*, vol. 56, iss. S1, 2011

A model-based safety concept for a rotary blood pump

Bibtex entry :

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@article { SGB+11,
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[SGW+11]

PDFBIB

Stollenwerk, A., Göbe, F., Walter, M., Arens, J., Kopp, R., and Kowalewski, S., "Smart Data Provisioning for Model-Based Generated Code in an Intensive Care Application", in *Proc. 3rd Joint Workshop On High Confidence Medical Devices, Software, and Systems & Medical Device Plug-and-Play Interoperability : HCMDSS/MDPnP 2011 ; in conjunction with CPSweek 2011 ; April 11, 2011 Chicago, USA, Chicago, 2011, HCMDSS/MDPnP 2011 ; in conjunction with CPSweek 2011 ; April 11, 2011 Chicago, USA*, p. 8.

Smart Data Provisioning for Model-Based Generated Code in an Intensive Care Application

Bibtex entry :

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@inproceedings { SGW+11,
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[WBA+11]

[PDFBIB](#)

Walter, M., Brendle, C., Arens, J., Stollenwerk, A., Kopp, R., Bensberg, R., and Leonhardt, S., "Physiological target control in long term extracorporeal oxygenation", in *Proc. The international journal of artificial organs*, Milano [u.a.], 2011, vol. 34 in 2011, Wichtig, pp. 625-625.

Physiological target control in long term extracorporeal oxygenation

Bibtex entry :

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@inproceedings { WBA+11,
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[AdM+10]

[PDFBIB](#)

Arens, J., de Brouwer, P., Mager, I., Kopp, R., Walter, M., Stollenwerk, A., Schmitz-Rode, T., and Steinseifer, U., "A dynamic study on the hemolytic effect of negative pressure on blood", in *Proc. ASAIO journal*, Hagerstown, Md., 2010, vol. 56, Lippincott, pp. 96-96.

A dynamic study on the hemolytic effect of negative pressure on blood

Bibtex entry :

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@inproceedings { AdM+10,
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[SDK10]

[PDFBIB](#)

Stollenwerk, A., Derks, A., and Kowalewski, S., "A Modular, Robust and Open Source Microcontroller Platform", in *Proc. Proceedings / 2010 Workshop on Embedded Systems Education : WESE 2010 ; Scottsdale, AZ, USA, October 28th, 2010 / Eds.: Peter Marwedel ...*, New York, NY, 2010, ACM, pp. 48-54.

A Modular, Robust and Open Source Microcontroller Platform

Bibtex entry :

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@inproceedings { SDK10,
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[SJA+10]

[PDFBIB](#)

Stollenwerk, A., Jörgens, J., Arens, J., Walter, M., Kopp, R., and Kowalewski, S., "Model Based Diagnosis for Extracorporeal Membrane Oxygenation", in *Proc. The international journal of artificial organs*, Milano [u.a.], 2010, vol. 33, Wichtig Ed., pp. 447-447.

Model Based Diagnosis for Extracorporeal Membrane Oxygenation

Bibtex entry :

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@inproceedings { SJA+10,
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[SJW+10]

[PDFBIB](#)

Stollenwerk, A., Jörgens, J., Walter, M., Arens, J., Kopp, R., and Kowalewski, S., "Modellbasierte Fehlerdiagnose eines Membranoxygenators", *Proceedings : Jahrestagung der Deutschen Gesellschaft für Biomedizinische Technik (DGBMT) im VDE*, vol. 55, iss. S 1, pp. 174-177, 2010

Modellbasierte Fehlerdiagnose eines Membranoxygenators

Bibtex entry :

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@article { SJW+10,
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[SLW+10]

PDFBIB

Stollenwerk, A., Lang, M., Walter, M., Arens, J., Kopp, R., and Kowalewski, S., "Sicherheitskonzept für eine intensivmedizinische Anwendung am Beispiel der EMCO", in *Proc. Entwurf komplexer Automatisierungssysteme : EKA 2010 ; Beschreibungsmittel, Methoden, Werkzeuge und Anwendungen ; 11. Fachtagung mit Tutorium, 25. bis 27. Mai 2010 in Magdeburg, Denkfabrik im Wissenschaftshafen / ifak, Institut für Automation und Kommunikation e.V., Magdeburg; Otto-von-Guericke-Universität Magdeburg, Institut für Automatisierungstechnik. [Hrsg.: Ulrich Jumar, Eckehard Schnieder, Christian Diedrich], Magdeburg, 2010, ifak, pp. 65-74.*

Sicherheitskonzept für eine intensivmedizinische Anwendung am Beispiel der EMCO

Bibtex entry :

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@inproceedings { SLW+10,
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[WLK+10]

PDFBIB

Walter, M., Leonhardt, S., Kopp, R., Wartzek, T., Arens, J., and Stollenwerk, A., "Automatisierung und Fehlerdiagnose bei der extrakorporalen Membranoxygenierung", *Automatisierungstechnik : at*, vol. 58, iss. 5, pp. 277-285, 2010

Automatisierung und Fehlerdiagnose bei der extrakorporalen Membranoxygenierung

Bibtex entry :

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@article { WLK+10,
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[WLK+10a]

PDFBIB

Walter, M., Leonhardt, S., Kopp, R., Arens, J., Weyer, S., and Stollenwerk, A., "A physiological model for extracorporeal oxygenation controller design", *Conference proceedings of the ... annual international conference of the IEEE Engineering in Medicine and Biology Society*, vol. 2010, pp. 434-437, 2010

A physiological model for extracorporeal oxygenation controller design

Bibtex entry :

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@article { WLK+10a,
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    and Arens, Jutta and Weyer, S{"o}ren and Stollenwerk,
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[KWA+09]

[PDFBIB](#)

Kopp, R., Walter, M., Arens, J., Stollenwerk, A., Leonhardt, S., Schmitz-Rode, T., Kowalewski, S., and Rossaint, R., "Regelungs- und Sicherheitskonzepte für extrakorporale zur Lungenunterstützung", *Biomedizinische Technik = Biomedical engineering*, vol. 54, iss. 5, pp. 289-297, 2009

Regelungs- und Sicherheitskonzepte für extrakorporale zur Lungenunterstützung

Bibtex entry :

```

@article { KWA+09,
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[LWW+09]

PDFBIB

Leonhardt, S., Walter, M., Wartzek, T., Kashefi, A., Stollenwerk, A., and Kopp, R., "Regelung des Gasaustauschs für die extrakorporale Oxygenierung", in *Proc. Automation 2009 : der Automatisierungskongress in Deutschland ; Kongress Baden-Baden, 16. und 17. Juni 2009 ; [10. Branchentreff der Mess- und Automatisierungstechnik] / VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik. - 2067*, Düsseldorf, 2009 in VDI-Berichte, VDI-Verl., pp. 281-285.

Regelung des Gasaustauschs für die extrakorporale Oxygenierung

Bibtex entry :

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@inproceedings { LWW+09,
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[10. Branchentreff der Mess- und Automatisierungstechnik] /
VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik. -
2067 },
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[SJK09]

PDFBIB

Stollenwerk, A., Jongdee, C., and Kowalewski, S., "An undergraduate embedded software laboratory for the masses", in *Proc. Workshop on Embedded Systems Education (WESE09), Grenoble, France, Grenoble, France, 2009*, ACM, pp. 34-41.

An undergraduate embedded software laboratory for the masses

Bibtex entry :

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@inproceedings { SJK09,  
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[SL09]

[PDFBIB](#)

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Embedded Contributions to an Intensive Care Safety Concept

Bibtex entry :

```
@conference { SL09,  
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[SWW+09]

PDFBIB

Stollenwerk, A., Walter, M., Wartzek, T., Kopp, R., Arens, J., and Kowalewski, S., "A safety and control concept for extracorporeal membrane oxygenation", *The international journal of artificial organs*, vol. 32, iss. 7, pp. 428-428, 2009

A safety and control concept for extracorporeal membrane oxygenation

Bibtex entry :

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@article { SWW+09,
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[WLK+09]

PDFBIB

Walter, M., Leonhardt, S., Kopp, R., Kashefi, A., Wartzek, T., and Stollenwerk, A., "Automation of long term extracorporeal oxygenation systems", in *Proc. ECC 09 : Proceedings of the European Control Conference 2009 ; the 10th in the EUCA Series ; 23-26 August 2009, Budapest, Hungary / General Chair: László Keviczky ...*, Budapest, 2009, EUCA.

Automation of long term extracorporeal oxygenation systems

Bibtex entry :

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@inproceedings { WLK+09,
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[WWS+09]

[PDFBIB](#)

Wartzek, T., Walter, M., Stollenwerk, A., Kopp, R., Kashefi, A., and Leonhardt, S.,
 "Automatisierung der extrakorporalen Membranoxygenierung", in *Proc.
 Automatisierungstechnische Verfahren für die Medizin : 8. Workshop ; Tagungsband / Thomas
 Schauer ... (eds.)*, Düsseldorf, 2009 in Fortschritt-Berichte VDI : Reihe 17,
 Biotechnik/Medizintechnik, VDI-Verlag, pp. 25-26.

Automatisierung der extrakorporalen Membranoxygenierung

Bibtex entry :

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@inproceedings { WWS+09,
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