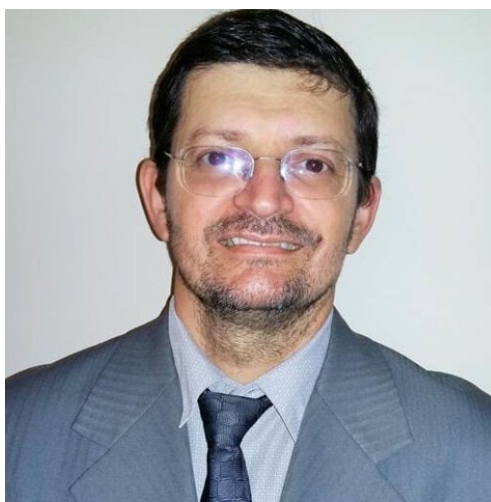


## Research Seminar

# Electrical Bioimpedance at UDESC: from bench to bedside



*Professor Pedro Bertemes-Filho, UDESC, Brazil*

### Date/Time/Location

23<sup>rd</sup> June 2026, 11AM – 12:30PM NZST

In-person: WG404, AUT City Campus

On-line: Microsoft Teams

### Summary

This seminar presents 25 years of research by Prof Pedro Bertemes-Filho (UDESC, Brazil) on electrical bioimpedance spectroscopy (EIS) — a technique that measures the frequency-dependent electrical properties of biological tissues to extract clinically relevant information. The talk traces a clear translational arc: starting from foundational instrumentation work at the University of Sheffield, where his landmark 2000 paper comparing Howland current source topologies for electrical impedance tomography established a global reference for EIS circuit design. This was followed by a series of progressively refined current source designs - the high-impedance EHCS (Rev. Sci. Instrum. 2017) and mirrored feedback-controlled circuit (Rev. Sci. Instrum. 2019) - that are now widely used in wearable and microelectrode-based systems worldwide. On the sensing and clinical side, the group pioneered the use of EIS for cervical cancer screening in Brazil, collecting over 100 tissue samples across 5 hospitals in Santa Catarina and achieving 97% pattern recognition accuracy - the first bioimpedance clinical study of its kind in the country. Smart impedance probes were also developed for skin cancer detection, food quality control (bovine milk, fish), biosensors, and 3D cell culture monitoring.



The most recent and impactful outcome is *eGluco*, a wearable smartwatch for non-invasive blood glucose monitoring. Built on a physical analytical model based on Bruggeman's effective medium theory (Sensors 2020, 33 citations), the device reached 97.6% prediction accuracy in a clinical trial with 67 ICU patients, is currently deployed at Hospital Azambuja in Brusque (SC), and has 100 units entering production following selection in a national Brazilian health technology call. Four patents have been filed (2023–2025), including an ASIC chip integrating the full EIS front-end. With over 1,520 Google Scholar citations, 6 books edited, 4 active patents, and active roles as IEEE Senior Member and ISEBI Secretary, the research programme demonstrates a sustained ability to move from precision electronics to clinical devices — with open collaboration opportunities in AI-EIS fusion, viral point-of-care diagnostics, food traceability, and wearable medical devices.

### Bio

**Pedro Bertemes-Filho** was born in Florianópolis, Brazil, in 1970. He holds a Bachelor's degree in Electrical Engineering from the State University of Santa Catarina (UDESC, 1995), a Master's in Electrical Engineering from the Federal University of Santa Catarina (UFSC, 1998), and a PhD in Medical Physics from the University of Sheffield, UK (2002). He completed postdoctoral studies at the University of São Paulo (2003–2004), the University of Sheffield (2012–2013), and Dartmouth College, USA, as a Fulbright Visiting Scholar (2017). He is currently a Full Professor in the Department of Electrical Engineering at UDESC (Joinville campus), where he has taught since 2004. He leads the Research Group on Biomedical Engineering. His research focuses on electrical bioimpedance spectroscopy, electrical impedance tomography, electronic instrumentation, and biosensors, with applications ranging from cancer diagnosis and non-invasive glucose monitoring to food quality control. He is the lead developer of *eGluco*, a wearable smartwatch for non-invasive blood glucose measurement, which has received national recognition and is currently in production. He has authored or co-authored over 70 peer-reviewed journal articles (with more than 1,500 citations on Google Scholar), 6 books, and more than 20 book chapters. He holds 4 patents and has supervised more than 25 master's and doctoral students. Bertemes-Filho is a Senior Member of the IEEE, and a reviewer for over 15 international journals, including IEEE Transactions on Biomedical Engineering and Physiological Measurement. Recently, he is acting as a Guest Editor in the special issue “Bioimpedance-based Biosensors” from Biosensors journal.

