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DATA-DRIVEN MODELLING OF THE HUMAN CARDIOVASCULAR SYSTEM FOR UNDERSTANDING, DIAGNOSIS, TREATMENT AND MANAGEMENT

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ABSTRACT

Advances in data science, coupled with computational modelling, AI-based pathway identification and other areas of biomedical engineering, are enabling a new generation of cardiovascular models [1] that integrate patient-specific data with physics-based representations. Such data-driven approaches can leverage large volumes of multimodal information from medical imaging, wearable sensors, and clinical records to capture the complex, adaptive behaviour of the human cardiovascular system more accurately than traditional models alone.

Machine learning, statistical inference, and hybrid modelling frameworks now make it possible to identify disease signatures, forecast progression, and optimise treatment strategies. These techniques also support the creation of cardiovascular "digital twins" that fuse continuous data streams with computational simulations for real-time monitoring, diagnosis, and personalised intervention.

This mini-symposium will bring together researchers, clinicians and industry professionals to share advances in data integration, patient-specific modelling, uncertainty quantification and case studies. Topics will include hybrid modelling, data assimilation, clinical decision support and adoption in healthcare. The session will showcase how data-driven cardiovascular modelling can enhance diagnosis, treatment planning and long-term management, advancing predictive and personalised medicine.

REFERENCES

[1] A. Arzani and S.T.M Dawson, *Data-driven cardiovascular flow modelling: examples and opportunities,* Journal of The Royal Society Interface., 18 no.175 (2021): 20200802