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Hydraulics Assumptions for the Computation of Electrical Conductivity of Flowing Human Blood

Katrin Ellermann*

Program Manager, Associate Professor, University of Graz Technology, Austria

Abstract

Impedance cardiography may be a non-invasive methodology for measuring cardiodynamic parameters, like stroke volume and pulse, also as flow. For the measurement, the electrical conductivity of blood is vital. The conductivity of blood depends on various parameters, like the haematocrit value also because the red blood cells' (RBC) shape and orientation. In models, the response is typically suffering from uncertainty, which can cause inaccurate diagnosis. Therefore, a ranking of the influence of the model's input factors could also be necessary. Also, physically and physiologically correct assumptions are fundamental for the accuracy of the model. the idea for predicting the conductivity of blood during this study is that the Maxwell–Fricke theory, which allows computing the electrical bulk conductivity of quiescent blood. For flowing blood, hydraulics has got to be coupled within the modelling phase.

Nevertheless, some assumptions may cause invalid or inaccurate results. supported a worldwide sensitivity analysis, this work shows which fluid mechanical assumptions are incorrect and will be avoided. Moreover, positive effects supported accurate rheological modelling of the fluid properties are shown, and therefore the factors with a decisive influence on the computed conductivity change of flowing blood are illustrated.

Conclusions

The study showed the way to reduce the uncertainty of electrical conductivity of flowing blood and analysed the impact of various model assumptions on such blood property. The conductivity model described in Section 2.1 is including three different hydraulics model assumptions, namely Newtonian fluid and steady flow, Newtonian fluid and harmonically pulsating flow, non-Newtonian fluid and harmonically pulsating flow.

***Address for Correspondence:** Katrin Ellermann, Program Manager, Associate Professor, University of Graz Technology, Austria.*

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