6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

Optimal reconstruction of flows from doppler measurements.

Galarce F.[1], **Gerbeau J.-F.**[1], **Lombardi D.**[1], **Mula, O.**[2]

[1] Inria Paris, 2 rue Simone Iff, 75012 Paris
[2] CEREMADE, Université Paris Dauphine, Place du Marchal Lattre de Tassigny 75775 Paris

Keywords: *Optimal reconstruction, doppler velocimetry, inverse problems*

Doppler ecography is one of the most commonly used measurement modalities of blood flow in clinical applications. It is cheap and non-invasive. A number of decisions are made based on this kind of measurement. Of the available data, only a small portion is actually used in order to infer useful parameters characterising the blood flow and the quantities of interest.

Based on the theoretical results in [1] and the methods proposed in [2], a numerical method is proposed in order to reconstruct the 3D flow in realistic geometries starting from doppler velocimetry data. Ultrasound measurements are modeled. These can be seen, with a good approximation, as linear forms applied to the flow, so that the problem can be formulated as follows: given a set of linear forms applied to the flow and perturbed by noise, what is the best way to reconstruct the flow?

A mathematical analysis is shown. In order to assess the performances of the proposed method some numerical experiments are proposed, on synthetic geometries and in a more realistic case, on patient carotid arteries data.

REFERENCES

[1] Binev, Peter and Cohen, Albert and Dahmen, Wolfgang and DeVore, Ronald and Petrova, Guergana and Wojtaszczyk, Przemyslaw, *Data assimilation in reduced modeling*.SIAM/ASA Journal on Uncertainty Quantification, 2017.

[2] Y. Maday, O. Mula, A.T. Patera and M. Yano, *The Generalized Empirical Interpolation Method: Stability theory on Hilbert spaces with an application to the Stokes equation*, CMAME, 2015