A velocity tracking approach for the data assimilation problem in blood flow simulations

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Abstract

Data Assimilation techniques have been recently applied to improve the accuracy of patient-specific simulations of the blood flow. In particular, in [1], techniques based in variational approaches were shown to be able to successfully reconstruct the blood flow profile, even when in the presence of noisy measurements. In [2] and [3] the authors suggested a similar approach for the two-dimensional case, but taking the velocity profile on the boundary as the control variable. In the present work, we follow the same ideas and connect the well-posedness of the resulting control problem with recent existent results ([4]). Then, we describe a DO approach that leads to a nonlinear mathematical programming problem, which can be solved using a well established SQP nonlinear solver([5]). From several cases that were used to validate numerically this approach, we have chosen one three-dimensional realistic pathological case for illustration purposes.

Keywords: Boundary control, Data Assimilation, blood flow.

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