

**Title: Treatment of instabilities due to advection-dominance in POD solution to advection-diffusion-reaction equations**

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**Abstract:** In this work, we address one of the main drawbacks of POD-ROM, namely their numerical instabilities when applied to advection-dominated advection-diffusion-reaction equations. In particular, we propose a three-stage stabilizing strategy that will be very useful when considering very low diffusion coefficients, i.e. in the strongly advection-dominated regime. This approach mainly consists in three ingredients: (1) the addition of a “streamline diffusion” stabilization term to the governing projected equations, (2) the modification of the correlation matrix defining the POD modes associated to the advection stabilization term, and (3) an a-posteriori stabilization scheme. Numerical studies are performed to discuss the accuracy and performance of the new method in handling strongly advection-dominated cases.