Optimisation of sensor locations for falling film problems based on importance maps[1] FANGXIN FANG, ZHIZHAO CHE, JAMES PERCIVAL, CHRIS PAIN, Imperial College London, MICHAEL NAVON, Florida State University, OMAR MATAR, Imperial College London — In studying complex flow problems, it is essential to simulate or measure key parameters accurately and place sensors at the locations with high "importance." This study attempts to build a systematic linkage between experimental measurements and numerical simulations through sensitivity analysis, sensor optimisation, and data assimilation. An ensemble method is used to optimise sensor locations for falling film problems based on an "importance" map. This map can identify the important regions in the time-space domain according to a "target" function. The sensor locations are selected based on the importance map, the variation of the variables, and the costs of performing the measurements. The results of the data assimilation study show that assimilating data from optimised sensor locations can significantly reduce model uncertainty and more accurately reproduce the true system. The required number of sensors can be reduced significantly by using optimised sensors. This method can be used not only in falling film problems, but also in other complex flow problems in numerous applications.

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