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A COMPARISON OF PARTICLE FILTERS APPLIED TO THE HEAT TRANSFER COEFFICIENT ESTIMATION IN INTERNAL COMBUSTION ENGINES

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This paper demonstrates the capability of particle filters for sequentially estimating the heat transfer coefficient between the hot gases and the cylinder walls of a combustion chamber in a internal combustion engine. Particle filters, also called Sequential Monte Carlo (SMC) methods, fit into the domain of inverse modelling procedures, where measurements are incorporated into a computational model so as to formulate some feedback information on the uncertain model state variables and/or parameters, through accurate representations of their probability density functions. Based on a simple sampling importance distribution and resampling techniques, particle filters combine Monte Carlo samplings with sequential Bayesian filtering problems. This study compares the performance of the Sampling Importance Resampling (SIR) and of the Auxiliary Sampling Importance Resampling (ASIR) filters for the sequential estimation of the time dependent heat transfer coefficient, using measured pressures taken inside the combustion chamber; results indicate that both the SIR and the ASIR filters are able to accurately capture the unknown function, with a small computational cost. Particle filters show, therefore, their good ability to predict internal combustion engines parameters that cannot be directly measured, with good accuracy.