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MULTI-OBJECTIVE SURROGATE BASED OPTIMIZATION OF GAS CYCLONES USING SUPPORT VECTOR MACHINES AND CFD SIMULATIONS

Khairy Elsayed[1,2], **Chris Lacor**[1]

[1] Vrije Universiteit Brussel, Department of Mechanical Engineering, Research Group Fluid Mechanics and Thermodynamics, Pleinlaan 2, 1050 Brussels, Belgium, {kelsayed, chris.lacor}@vub.ac.be

[2] Mechanical Power Engineering Department, Faculty of Engineering at El-Mattaria, Helwan University, Masaken El-Helmia P.O., Cairo 11718, Egypt, kelsayed75@gmail.com

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Gas cyclones are widely used in many industrial application due to low construction costs, high reliability and low operating costs. Both the pressure drop (Euler number) and the cut-off diameter (Stokes number) in a cyclone separator can be decreased or increased by varying the cyclone dimensions. For an accurate optimal design of a cyclone, it is quite necessary to use a reliable model for its performance parameters. Optimization of gas cyclone is, indeed, a multi-objective optimization problem rather than a single objective optimization problem that has been considered so far in the literature [1, 2]. These objective functions are either obtained from experiments, empirical models or computed using very timely and high-cost computational fluid dynamic (CFD) approaches. Modeling and optimization of the parameters are investigated in the present study, by using support vector regression (SVR) metamodel (trained by CFD simulations data set) and multi-objective genetic algorithm optimization technique in order to minimize the Euler number and Stokes number. In this article, we propose a novel approach to enhance the accuracy of the fitted SVR model. Figure 1 presents a sample of the obtained results.

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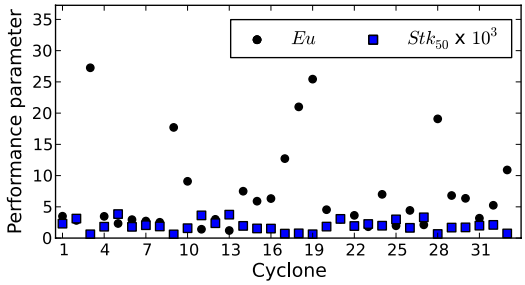
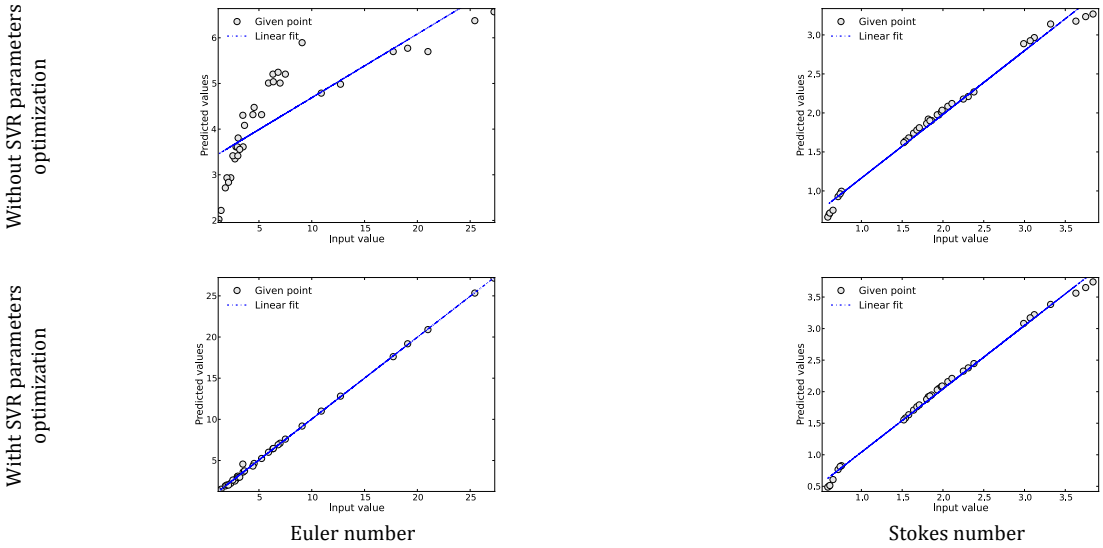
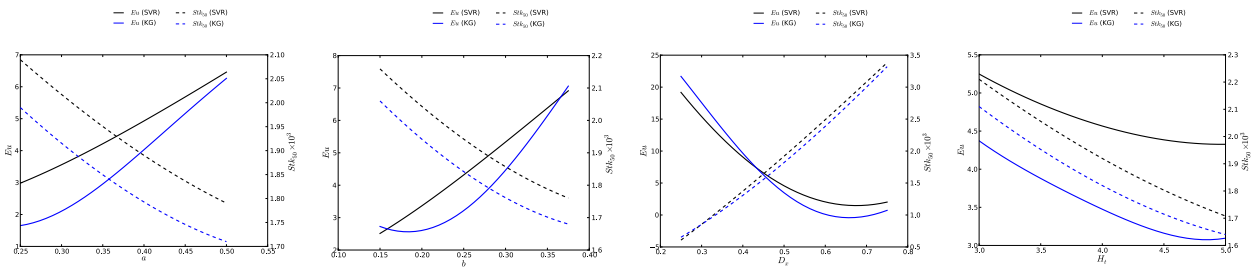


(a) The input training data for 33 test cases



(b) Input versus predicted values



(c) The effect of the four geometrical parameters on the performance

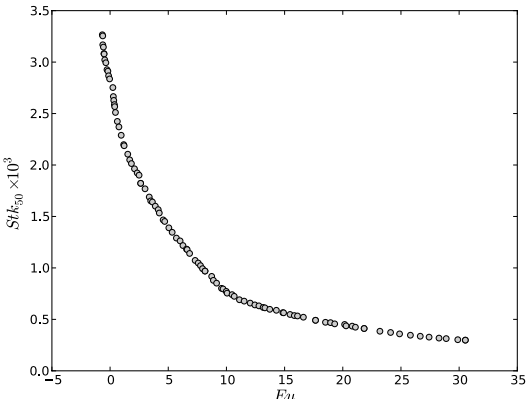


Figure 1: Sample of results