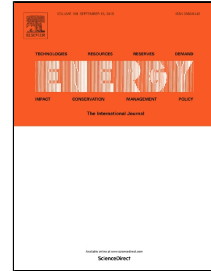


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EVALUATING PERFORMANCES OF 1-D MODELS TO PREDICT VARIABLE AREA SUPERSONIC GAS EJECTOR PERFORMANCES

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Abstract

The application of supersonic gas ejector with variable area nozzle can be found in different industries. However, due to different types of variable area nozzle, performance prediction is mainly focused on costly numerical simulations. In this paper, one-dimensional models for performance prediction of variable area gas ejector with specially designed nozzle, were compared. Additionally, operational lines and corresponding modes were analyzed. Two different variable area ejectors were experimentally tested. The first ejector used natural gas as motive fluid, whereas in the second one motive gas was the composition of alkane. Six distinct correlations of ejector component efficiencies were evaluated. Sum of absolute relative errors and coefficient of determination were used as goodness of fit criteria. The results showed that best model has coefficient of determination 0.76 and 0.63 in the case of natural and R2 gas as motive fluids, respectively. In order to improve prediction performances of entrainment ratio, the mixture of experts machine learning technique was used. Moreover, the results of obtained conditional probabilities of models are visualized in space spanned by area and pressure ratios. The presented analysis showed that one model is not generally better than others and can be improved by using an ensemble of models.

Keywords: variable area nozzle, supersonic gas ejector, mixture of experts, experimental study, antlion algorithm

Nomenclature

\dot{m} , kg/s, mass flow rate

a_{*x} , m/s, velocities at chocking conditions

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