

## CNN-Based Compressor Mass Flow Estimator in Industrial Aircraft Vapor Cycle System

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**Abstract :** In vapor cycle systems, the mass flow sensor plays a key role for different monitoring and control purposes. However, physical sensors can be inaccurate, heavy, cumbersome, expensive, or highly sensitive to vibrations, which is especially problematic when embedded into an aircraft. The conception of a virtual sensor, based on other standard sensors, is a good alternative. This paper has two main objectives. Firstly, a data-driven model using a convolutional neural network is proposed to estimate the mass flow of the compressor. We show that it significantly outperforms the standard polynomial regression model (thermodynamic maps) in terms of the standard MSE metric and engineer performance metrics. Secondly, a semi-automatic segmentation method is proposed to compute the engineer performance metrics for real datasets, as the standard MSE metric may pose risks in analyzing the dynamic behavior of vapor cycle systems.

**Keywords :** deep learning, convolutional neural network, vapor cycle system, virtual sensor

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