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Convolutional Neural Networks for Wake Flow Predictions THARINDU MIYANAWALA, RAJEEV JAIMAN, Natl Univ of Singapore — We present a Convolutional Neural Network (CNN) based deep-learning technique to predict the wake flow characteristics at a low Reynolds number for different bluff body shapes. The discrete convolution process with non-linear rectification approximates the mapping between the bluff body shape and the wake flow characteristics. The CNN is fed by an Euclidean distance function as the input and target data generated by full order Navier-Stokes (NS) computations for primitive bluff body shapes. The CNN is designed to predict the key flow dynamic parameters such as the Strouhal number, force coefficients and mean velocity and pressure fields. The CNN processes are iteratively trained using a gradient descent method. The CNN is then used to predict the flow characteristics of different geometries and the results are found to be consistent with the NS-based computations. A convergence study is performed to identify the effective dimensions of the CNN e.g. the convolution kernel size, number of kernels and convolution layers. The CNN prediction has a speed-up nearly two-orders of magnitude with less than 5% error compared to the full-order results. This technique provides a good trade-off between the speed versus accuracy to predict the wake flow characteristics for interactive design.

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