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Assessment of the Derivative-Moment Transformation method for unsteady-load estimation ALI MOHEBBIAN, DAVID RIVAL, University of Calgary — It is often difficult, if not impossible, to measure the aerodynamic or hydrodynamic forces on a moving body. For this reason, a classical control-volume technique is typically applied to extract the unsteady forces instead. However, measuring the acceleration term within the volume of interest using PIV can be limited by optical access, reflections as well as shadows. Therefore in this study an alternative approach, termed the Derivative-Moment Transformation (DMT) method, is introduced and tested on a synthetic data set produced using numerical simulations. The test case involves the unsteady loading of a flat plate in a two-dimensional, laminar periodic gust. The results suggest that the DMT method can accurately predict the acceleration term so long as appropriate spatial and temporal resolutions are maintained. The major deficiency was found to be the determination of pressure in the wake. The effect of control-volume size was investigated suggesting that smaller domains work best by minimizing the associated error with the pressure field. When increasing the control-volume size, the number of calculations necessary for the pressure-gradient integration increases, in turn substantially increasing the error propagation.

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