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# Prediction of aerodynamic loads in arbitrary manoeuvre: identifying flow regimes

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## Abstract content <br>   (Max 300 words)

There is an increasing need to predict aerodynamic loads on manoeuvring aircraft. Usually, analyses of geometrically complex configurations have been carried out using numerical solutions of discrete approximations to the Navier-Stokes equations in a body frame attached to a moving object. This is usually an inertial frame. In compressors and turbines, and for geophysical flows, solution is performed in a frame rotating with constant angular velocity.
Rotating transforms of the Navier-Stokes equations are well known [1][2][3], but a general model for arbitrary manoeuvre has been provided by Löfgren [4]. A choice was made to implement a numerical form in the absolute frame [5] in a finite-volume structured-grid formulation [6]. The results of the three-dimensional general implementation were validated and the simulation is capable of modelling aerodynamic loads, including drag, in arbitrary manoeuvre [7].
However, we still need to characterise flow regimes for exploration of this new field. For this purpose we use Forsberg's transformation, with explicit expansion of the force terms in the relative frame, to derive dimensionless parameters which may be used as a linear guide to flow behaviour under limited conditions. In this paper, we show results for the predictions of this rather crude methodology in comparison with loads on a generic store modelled with the new Computational Fluid Dynamics capability. The store is a rolling hemisphere-cylinder with fins and strakes. Disruption of the fin aerodynamics by vortices originating on the strakes is the subject of this study.

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no

## Would you like to <br> submit a short paper <br> for the Conference <br> Proceedings (Yes / No)?

yes

**Primary author:** Dr GLEDHILL, Irvy (Igle) (CSIR)

**Presenter:** Dr GLEDHILL, Irvy (Igle) (CSIR)

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