VSP2WOPWOP User Manual

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Nomenclature

(Nomenclature entries should have the units identified)

A =   amplitude of oscillation

a =   cylinder diameter

C_p =   pressure coefficient

Cx =   force coefficient in the x direction

Cy =   force coefficient in the y direction

c   =   chord

dt =   time step

Fx = X component of the resultant pressure force acting on the vehicle

Fy = Y component of the resultant pressure force acting on the vehicle

f, g =   generic functions

h =   height

i =   time index during navigation

j =   waypoint index

K =   trailing-edge (TE) nondimensional angular deflection rate

Θ =   boundary-layer momentum thickness

ρ =   density

Subscripts

cg   =   center of gravity

G =   generator body

iso   =   waypoint index

I. Introduction

VSP2WOPWOP couples NASA's parametric aircraft geometry tool, Open Vehicle Sketch Pad (OpenVSP) with the acoustic prediction code PSU-WOPWOP. OpenVSP enables users to rapidly develop and modify blade geometries,

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particularly since they are parameterized in familiar terms, e.g., chord, twist, sweep. VSP2WOPWOP uses the degenerate blade geometry output from OpenVSP, in conjunction with airfoil cross section polars attained from MIT's XFoil panel code, to compute the blade loads based on blade element momentum theory (BEMT). The blade geometry and loading information is then written as binary patch and data input files for PSU-WOPWOP. The intent of this program is to (1) minimize the learning curve faced by new researchers working with PSU-WOPWOP and to (2) provide a framework for conducting large parametric studies of blade geometries and operating conditions, were manual modification of individual test cases may not be practical.

II. Getting Started

1) Creating geometry — orientation
2) Obtaining Xsec polar
3) Brief input module description
4) Running VSP2WOPWOP
5) Loading dictionaries and saved variables
6) Running PSU-WOPWOP

III. Theory

A. Hover

B. Forward Flight

IV. Validation

V. Program Structure

1) input.py

VI. Modules

VII. Appendices

1) Define all variables in MainDict