Orbital and Attitude Dynamics Simulation for Nano- and Picosatellites

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ABSTRACT

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LIST OF FIGURES

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LIST OF NOTES

NOMENCLATURE

UNITS

All units of measurement throughout this thesis conform to the *Système Internationale*, with deviations from this rule noted where appropriate.

NOTATION

This section describes the general form of notation for properties such as scalars, vectors and matrices and their derivatives.

TIME DERIVATIVES

$\dot{x}$	first derivative of x with respect to time
$\ddot{x}$	second derivative of x with respect to time
$x^{(n)}$	nth derivative of x with respect to time

SCALARS, VECTORS AND MATRICES

x	scalar
$\mathbf{x}$	vector or matrix
$\mathbf{x}^T$	transpose of vector or matrix
x_i	ith element of vector $\mathbf{x}$
$f(x)$	function of scalar x
$f(\mathbf{x})$	function of vector or matrix $\mathbf{x}$
$f_{\mathbf{x}}$	Jacobian of $f(\mathbf{x})$ with respect to $\mathbf{x}$

SYMBOLS

The following symbols are used throughout this thesis. Where a symbol is used only briefly, it is defined at the appropriate point in the text.

LATIN

C_d	aerodynamic drag coefficient [–]
F, $\mathbf{F}$	force [N]
g	acceleration due to gravity [$\mathrm{m\,s^{-2}}$]
i	current [A]
L, M, N	rotational forces [N m]
$\mathbf{M}$	moment [N m]
m	mass [kg]
R	resistance [Ω]
u, v, w	surge, sway and heave velocities [$\mathrm{m\,s^{-1}}$]
V	magnitude of velocity [$\mathrm{m\,s^{-1}}$]
V_a	voltage applied to circuit [V]
X, Y, Z	linear forces [N]
x, y, z	components of position [m]

GREEK

β	slip angle [rad]
ϕ, θ, ψ	roll, pitch and yaw displacements [rad]
ρ	atmospheric density [$\mathrm{kg\,m^{-3}}$]
σ	friction coefficient [–]
ω	rotational speed [$\mathrm{rad\,s^{-1}}$]
$\boldsymbol{\omega}$	angular velocity vector [$\mathrm{rad\,s^{-1}}$]

SUBSCRIPTS

k	iteration of inverse simulation
n	iteration of Newton-Raphson method

ABBREVIATIONS

FDIR	fault detection, isolation and reconfiguration
InvSim	inverse simulation
NED	north-east-down

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INTRODUCTION

Put stuff in here at some point, including:

- Previous work
- Taxonomy of rovers
- Inverse simulation

2

ORBITAL DYNAMICS

2.1 KEPLER STUFF

2.2 ORBITAL ELEMENTS

2.3 FRAMES OF REFERENCE

2.4 MORE COMPLEX STUFF

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