

Aerobraking Guidance, Navigation and Control

A Comparison of State Variables Performance in Propagation

Delft University of Technology

MICHELE FACCHINELLI



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A Comparison of State Variables Performance in Propagation

by

MICHELE FACCHINELLI

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Cover picture by Jet Propulsion Laboratory, depicting Mars Reconnaissance Orbiter during Aerobraking. Available at <https://goo.gl/tKorKM>.



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List of Symbols

Latin Symbols:

c	Speed of light	$[m\ s^{-1}]$
g	Gravitational acceleration	$[m\ s^{-2}]$
\mathcal{R}	Universal gas constant	$[J\ mol^{-1}\ K^{-1}]$
\mathbf{x}	State vector	variable
$\mathbf{0}$	Zero matrix	$[-]$

Greek Symbols:

α	Angle of attack	$[rad]$
μ	Standard gravitational parameter	$[m^3\ s^{-2}]$
σ	Stefan-Boltzmann constant	$[W\ m^{-2}\ K^{-4}]$
ω or ω	Angular velocity	$[rad\ s^{-1}]$

Sub- and Superscripts:

A	Airspeed
grav	Gravitational
L	Lift

Reference Frames:

\mathcal{F}_B	Body-fixed reference frame
\mathcal{F}_I	Inertial planetocentric reference frame
\mathcal{F}_R	Rotating planetocentric reference frame
\mathcal{F}_V	Vertical reference frame

Special Characters:

$\hat{\square}$	Unit vector
\square^S	Skew-symmetric matrix in terms of vector elements
\square^T	Matrix transpose
$\ \square\ $	Magnitude of vector
$\bar{\square}$	Average
$\hat{\square}$	Estimated value
\square'	Intermediate value
$\overline{\square}$	Normalized
\square^\circledast	Optimal value
\square'	Post-maneuver value
\triangleq	Defined as
\leftarrow	Transformation to

Astronomical Symbols:

\odot	Sun
φ	Venus
$\ddot{\odot}$	Earth

☽	Moon
♂	Mars
♃	Saturn
♄	Titan
♈	Vernal equinox

Chemical Formulas:

Ar	Argon
CH ₄	Methane
CO	Carbon monoxide
CO ₂	Carbon dioxide
H	Monoatomic hydrogen
H ₂	Diatomeric hydrogen
H ₂ O	Dihydrogen monoxide
He	Helium
N ₂	Nitrogen
O	Monoatomic oxygen
O ₂	Diatomeric oxygen
O ₃	Ozone

List of Abbreviations

ESA	European Space Agency
JPL	Jet Propulsion Laboratory
LaRC	Langley Research Center
NASA	National Aeronautics and Space Administration
RK4	Runge-Kutta Fourth-order Integrator
Tudat	TU Delft Astrodynamics Toolbox
TU Delft	Delft University of Technology

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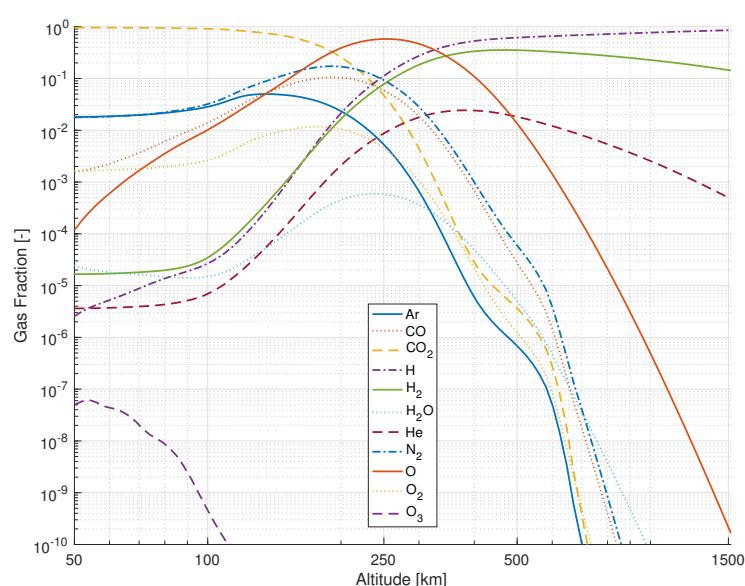


Figure 1.1: This is an example figure. You can also refer to the author of this figure (Facchinel, 2018). This figure, by the way, shows the gas concentrations as a function of altitude, for the atmosphere of Mars.

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Bibliography

Facchinelli, M., "Aerobraking Guidance, Navigation and Control," Master Thesis, Delft University of Technology, October 2018.

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