

Accepted Manuscript

Rarefied aerodynamic characteristics of aero-space-planes: A comparative study of two gas–surface interaction models

Gennaro Zuppari, Luigi Morsa, Raffaele Savino, Martin Sippel, Tobias Schwanekamp

PII: S0997-7546(15)00051-5

DOI: <http://dx.doi.org/10.1016/j.euromechflu.2015.04.003>

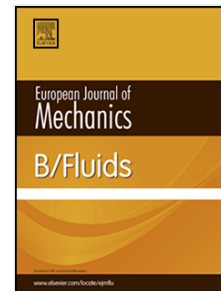
Reference: EJMFLU 2887

To appear in: *European Journal of Mechanics B/Fluids*

Received date: 26 November 2014

Revised date: 1 April 2015

Accepted date: 10 April 2015



Please cite this article as: G. Zuppari, L. Morsa, R. Savino, M. Sippel, T. Schwanekamp, Rarefied aerodynamic characteristics of aero-space-planes: A comparative study of two gas–surface interaction models, *European Journal of Mechanics B/Fluids* (2015), <http://dx.doi.org/10.1016/j.euromechflu.2015.04.003>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Rarefied aerodynamic characteristics of aero-space-planes: a comparative study of two gas-surface interaction models

Gennaro Zuppardi^{a(*)}, Luigi Morsa^a, Raffaele Savino^a

Martin Sippel^b, Tobias Schwanekamp^b

^a*Department of Industrial Engineering, University of Naples "Federico II", 80125 Naples, Italy*

^b*Space Launcher System Analysis (SART) DLR 28359 Bremen, Germany*

Abstract:

Accurate computations of aerodynamic forces are very important for the design of aero-space-planes. In rarefied flow, the computation of momentum and energy transfer between the flow and the vehicle's surface occurs in two steps: incidence and re-emission of gas molecules. While incidence is well understood, the re-emission process is still today not yet completely clear, thus many models have been developed. In the present paper, the effects of the re-emission models by Maxwell and by Cercignani-Lampis-Lord have been compared by means of direct simulation Monte Carlo (DSMC) codes. Two different study cases have been considered: a complete aero-space-plane and a wing profile. Computer simulations have been carried out using two DSMC codes to investigate hypersonic flows at an altitude of 120 km where for both the wing section and the vehicle the flow is in transitional regime. The results pointed out that the influence of the interaction models, considering specular, semi-specular and full diffusive re-emission is pretty strong, while the Cercignani-Lampis-Lord and the Maxwell models are almost equivalent.

Keywords:

Gas-surface interaction models,

Direct simulation Monte Carlo method,

Aerodynamic coefficients of an aero-space-plane.

(*) e-mail: zuppardi@unina.it

Download English Version:

<https://daneshyari.com/en/article/7051301>

Download Persian Version:

<https://daneshyari.com/article/7051301>

[Daneshyari.com](https://daneshyari.com)