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Title

Nitrous Oxide Modelling: from Single Phase Incompressible to FML Mass Flow Rate Model

Authors

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Abstract

Hydrazine is the state-of-the-art for various space propulsion systems applications varying from launchers, upper stages and satellites. However, hydrazine as a monopropellant and MMH (Monomethylhydrazine) or UDMH (Unsymmetrical Dimethylhydrazine) bipropellants are toxic, carcinogenic, and mutagenic. Special precautions have to be taken during all ground and operational phases when hydrazines are used. The toxicity and reactivity of hydrazine family propellants led to a significant increase in the costs for fuelling a spacecraft.

In this framework new “green” propellant technologies have been developed and their use and interest are increased both in commercial and institutional organization. In the definition of these new propellants, the word “Green” has to been intended as related to acute toxicity, due to their hydrazine alternative’s purpose.

Among the family of "green" propellants, one promising candidate to replace hydrazine is Nitrous Oxide. Alongside its "green" characteristics, N_2O owns an interesting property: self-pressurization. This added value makes Nitrous Oxide an important case study for the space propulsion industry, where the miniaturization trend requires storability, simplicity, lightness, and reliability in terms of propulsion unit [1]. Indeed, most propellants currently used do not possess self-pressurization feature and hence, they need to be pressurized. This is accomplished by turbo pumps or by expulsion systems (blowdown or regulated), which of course add weight and complexity to the propulsion system [2].

The aims of this paper are two: first compare the nitrous oxide mass flow rate models present in the literature with FML model [3] and finally presented a new preliminary conceptual mass flow rate model.

References

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