



## Ascent Heating Thermal Analysis on Spacecraft Adaptor Fairings

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When the Crew Exploration Vehicle (CEV) is launched, the spacecraft adaptor (SA) fairings that cover the CEV service module (SM) are exposed to aero heating. Thermal analysis is performed to compute the fairing temperatures and to investigate whether the temperatures are within the material limits for nominal ascent aero-heating case. The ascent heating is analyzed by using computational fluid dynamics (CFD) and engineering codes at Marshall Space Flight Center. The aero-heating environment data used for this work is known as Thermal Environment 3 (TE3) heating data. One of the major concerns is with the SA fairings covering the CEV SM and the SM/crew launch vehicle (CLV) flange interface. The TE3 heating

rate is a function of time, wall temperature, and the spatial locations. The implementation of the TE3 heating rate as boundary conditions in the thermal analysis becomes challenging.

The ascent heating thermal analysis on SA fairings and SM/CLV flange interface are performed using two commercial software packages: Cullimore & Ring (C&R) Thermal Desktop (TD) 5.1 and MSC Patran 2007r1 b. TD is the pre- and post-processor for SINDA, which is a finite-difference-based solver. In TD, the geometry is built and meshed, the boundary conditions are defined, and then SINDA is used to compute temperatures. MSC Pthermal is a finite-element-based thermal solver. MSC Patran

is the pre- and post-processor for Pthermal. Regarding the boundary conditions, the convection, contact resistance, and heat load can be imposed in different ways in both programs. These two software packages are used to build the thermal model for the same analysis to validate each other and show the differences in the modeling details.

*This work was done by Xiao Yen Wang, James Yuko, and Brian Motil of Glenn Research Center.*

*Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18471-1.*

## Entanglement in Self-Supervised Dynamics

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A new type of correlation has been developed similar to quantum entanglement in self-supervised dynamics (SSD). SSDs have been introduced as a quantum-classical hybrid based upon the Madelung equation in which the quantum potential is replaced by an information potential. As a result, SSD

preserves the quantum topology along with superposition, entanglement, and wave-particle duality. At the same time, it can be implemented in any scale including the Newtonian scale. The main properties of SSD associated with simulating intelligence have been formulated. The attention with this innova-

tion is focused on intelligent agents' interaction based upon the new fundamental non-Newtonian effect; namely, entanglement.

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## Prioritized LT Codes

**These forward erasure correcting codes apply proper matching of data priority and data redundancy to protect against packet drops in image, voice, and video transmissions where not all bits are created equal.**

*NASA's Jet Propulsion Laboratory, Pasadena, California*

The original Luby Transform (LT) coding scheme is extended to account for data transmissions where some information symbols in a message block are more important than others. Prioritized LT codes provide unequal error protection (UEP) of data on an erasure channel by modifying the original LT encoder. The prioritized algorithm improves high-priority data protection

without penalizing low-priority data recovery. Moreover, low-latency decoding is also obtained for high-priority data due to fast encoding. Prioritized LT codes only require a slight change in the original encoding algorithm, and no changes at all at the decoder. Hence, with a small complexity increase in the LT encoder, an improved UEP and low-decoding latency performance for high-

priority data can be achieved.

LT encoding partitions a data stream into fixed-sized message blocks each with a constant number of information symbols. To generate a code symbol from the information symbols in a message, the Robust-Soliton probability distribution is first applied in order to determine the number of information symbols to be used to compute the code symbol. Then,