

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I Design, Development and Verification (Launch Vehicles and Space Vehicles, including
their Mechanical/Thermal/ Fluidic Systems) (1)

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HOMEOSTATIC INFLATABLE DECENTRALIZED AUTONOMOUS STRUCTURES: INTELLIGENT
SPACE STRUCTURE USING INFLATABLE STRUCTURE AND DECENTRALIZED AUTONOMY

Abstract

Although inflatable structures exhibit considerable potential for use in the construction of space systems because of their high compression ratio and light weight, they exhibit numerous problems in case of partial damage. Furthermore, controlling the process and shape of these structures during deployment is difficult. These problems can be overcome by using homeostatic inflatable decentralized autonomous structures (HIDAS) using multiple autonomous inflatable cells. In HIDAS, the inflatable patterns of cells mitigate control loss resulting from partial damage. HIDAS can enhance decentralized autonomous intelligence and control the inflate sequence of the structure. Furthermore, HIDAS can achieve various functions, such as adapting autonomously to the unevenness of the ground and dynamically changing environment by changing its shape dynamically like a swarm. We developed an HIDAS prototype 5-m long with a 5-m diameter and demonstrated its functions. This study introduced HIDAS and validated its properties.