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New adaptive design of membrane based reflector for space application

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A novel methodology for the adaptive membrane structures which will be used for preliminary design of inflatable reflector for space application. The design methodology includes antenna performance, a set of different plots against antenna geometry parameters. Current approach demonstrated the design which can withstand at various temperature gradient and mechanical boundary conditions. The fuzzy based PID (proportional- integral- derivative) controller is used to control the linear displacement developed by macro fiber composites (MFC) under the positive feedback come by load cell. The adaptive device is used for giving the proper tension to prevent wrinkle in the membrane. The tension values are known (by simulation and experiment) for particular size of membrane. So, force sensor will read the current tension values and this goes to the control system and activate the MFC to give particular voltage to achieve required tension in membrane to get desired surface error. The control mechanism is based on neuro-fuzzy systems. Load cell measure the load applied on the membrane structures and MFC encounter the stress developed in the particular instant. This method confirms the results within the RMS of 0.5 mm. The initial design space of antenna geometries is a tool to help designers compare and select antenna topologies. A reduced by two orders of magnitude to a set of constraints satisfying designs.

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