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# 蜂窝夹芯旋转壳的屈曲分析

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# Buckling Analysis of Rotationally Periodic Sandwich Laminated Shells

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**摘要** 蜂窝夹芯复合材料旋转壳是航天器中的重要部件,且常常与其它部件互相联结,联结区局部高应力往往诱发复杂的局部屈曲模态,为此发展了一套有限元求解方案。针对蜂窝夹芯层合壳体构造了一种基于相对自由度技术的32节点三层壳元,这种单元避免了传统壳元的转动自由度,易与三维实体单元连接,使变厚度、带有补强的复合材料层合壳体等复杂结构得以正确建模。同时运用旋转周期结构有限元技术对大规模的空间蜂窝夹芯层合结构成功实施了屈曲分析。数值算例表明了计算策略的有效性和优越性。

**关键词：** 屈曲分析 复合材料 夹芯层合壳 有限单元法

**Abstract：** Sandwich laminated rotational shells are important parts of spacecraft, which are often connected with other components. The complicated local buckling modes are frequently caused by the local stress concentration at the joint areas. A finite element computational strategy of analyzing such structures is presented in this paper. A kind of 32-node and 3-layer shell element with relative Degrees-Of-Freedom (DOF) is developed for modeling sandwich laminated shells, which avoids resorting to the customary shell rotation DOFs and therefore can be easily connected with other solid type elements. All of these features enable its promising application in the simulation of modern sandwich structures, even if with varying thickness or complicated joint parts. For the buckling analysis of large-scale rotationally periodic aerospace sandwich structures, a computational strategy that combines the rotationally periodic FE method and this new shell element is adopted in this paper. The numerical results show the efficiency and advantages of this computational strategy.

**Keywords：** buckling analysis composite material sandwich laminated shell finite element method

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