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# Investigation of Imperfect Effect on Thermal Buckling of Cylindrical Shell with FGM Coating

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**Abstract**: The shell with functionally graded material (FGM) thermal barrier coating is a novel high temperature resistant structure, which has been increasingly applied in the aerospace, nuclear, turbo machinery and other engineering fields. However, there are some defects for the practical structures due to the limitation of manufacturing technique. But relevant theoretical research on the thermal buckling behavior of the imperfect cylindrical shell is limited in most open literature. Therefore, this work proposed to establish the theoretical solution of the critical temperature of buckling for the cylindrical shell with an axisymmetric imperfect and FGM coating based on the Donnell shell theory, Koiter model and Galerkin method. The theoretical solution deduced in this work agrees well with the existing literature. In addition, the influences of the profile of the axisymmetric imperfection, the volume fraction of the ceramic phase and the types of the thermal loading on the thermal buckling behavior of the coated imperfect cylindrical are further analyzed. The study provides a scientific solution and better understanding for the thermal buckling problem of the coated imperfect cylindrical shells.

**Key words:** Thermal buckling; Imperfection; FGM coating

## 1 Introduction

Functionally graded material (FGM), which is usually consisted of the metal phase and ceramic phase in microstructural level, is an innovative heterogeneous composite material (Talebizad et al., 2013; Wang et al., 2016). Different from normal fibre composites, the components and material properties of the FGM can smoothly and continuously vary along a certain direction according to engineering requirements (Sburlati, 2013). Therefore, FGM can avoid thermally or mechanically induced stress gap, which is generally caused by the inconsistency of the material