Examples of Non-commutative Groebner Bases to Plate Bending Analysis

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Abstract

The purpose of the talk is to demonstrate the utility of non-commutative Groebner bases in the analysis of plate bending problems, as an application part of results of a research collaboration between a symbolic computational research team (consisting of the second to forth authors) and a researcher in engineering mechanics (the first author) at RISC.

The plate examples in this study are the circular plates with linear and non-linear variable thickness or variable material properties which are commonly encountered in the areas of civil, mechanical, and aerospace engineering. All the evaluations are carried out by the current version of the GreenGroebner package in the framework of the Theorema symbolic software system in Mathematica developed by Buchberger's research group at RISC. The non-commutative Groebner basis methodology is used as a key technique and implemented in the GreenGroebner package introduced in the Ph.D. thesis of Markus Rosenkranz and developed further by L. Tec and A. Maletzky. The package produces the Green's operator and Green's function for a given LODE boundary problem. The study is found to be a unique alternative, worthy of further investigation, and potentially effective in the analysis of similar problems occurring in a variety of engineering applications.

Keywords: Non-commutative Groebner bases, Plate bending, Variable thickness