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In Aerospace Engineering

EDITOR

ERWIN SULAEMAN

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MINIMUM DENOMINATOR OF RATIONAL FUNCTION

13.1. Introduction

The finite element method of the present work is based on the flexibility method since it offers analytical solution by performing a direct integration to the Bernoulli-Euler differential equation. A direct integration is possible to perform to some elementary polynomial or rational functions. However, to find a flexibility matrix for a beam having arbitrary stiffness variation along its span, the differential equation becomes highly complicated such that it needs to be broken down into simpler rational functions. In the present Chapter, a procedure to transform arbitrary rational function to the elementary rational functions will be described. The procedure is the basis for the finite element method in Chapters 22 and 23.

13.2. Rational Function Transformation

A minimum denominator of rational function (MDRF) is defined in this Chapter as a sum of polynomial functions and rational function terms with minimum denominators. The minimum denominator is a denominator in the form of a polynomial function having only one root. A general expression of the MDRF function can be written as follow

$$\frac{\sum_{j=0}^{N_c} e_j x^j}{\prod_{j=1}^{N} \left(x - c_j\right)^{m_j}} = \sum_{j=1}^{N} \frac{a_j}{\left(x - c_j\right)^{m_j}} + \sum_{j=1}^{N} \sum_{k=1}^{m_j - 1} \frac{d_{jk}}{\left(x - c_j\right)^{k}} + \sum_{j=0}^{N_c - N_{tot}} b_j x^j \qquad (13.1)$$