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FORMATION OF STATICAL BASIS FOR EFFICIENT FORCE METHOD BY ANT COLONY OPTIMIZATION

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Abstract

An efficient algorithm is presented for the formation of statical basis, corresponding to highly sparse flexibility matrices for structures. This is achieved by applying a modified ant colony optimization algorithm for the formation of localized self-equilibrating systems. The efficiency of the present algorithm is illustrated through simple truss examples.

Keywords*:* Statical basis; self-equilibrating stress systems (S.E.Ss); self-stress matrix; flexibility matrix; sparsity; ant colony system

1. Introduction

The force method of structural analysis, in which the member forces are used as unknowns, is appealing to engineers, since the properties of members of a structure most often depend on the member forces rather than joint displacements.

Four different approaches are adopted for the force method of structural analysis, which are classified as:

1. Topological force methods,
2. Algebraic force methods,
3. Mixed algebraic-topological force methods,
4. Integrated force method.

Topological methods have been developed by Henderson [1] and Henderson and Maunder [2] for rigid-jointed skeletal structures. Development of general combinatorial approaches and methods suitable for computer programming are due to Kaveh [3-4]. Algebraic methods have been developed by Denke [5], Robinson [6], Topçu [7], Kaneko et al. [8], and mixed algebraic-topological methods have been used by Gilbert et al. [9],

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