Structural Characteristics and Analysis Simulation of New Core Truss Structure

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Abstract

The possibilities of the truss structure are extended and a new core truss structure (Square Core Truss structure, hereinafter referred to as SCT structure) is proposed. The SCT structure consists of four pairs of diagonal members connected by two panel points, and the structure is stabilized by using deformation restraint member in the space between the panel points. This causes contact problems between the diagonal members and the deformation restraint members, complicating the simulation of the boundary conditions. In this paper, a wooden pedestrian bridge with a span of 8m was designed and fabricated by structural analysis (3D framework analysis). Static loading experiment was conducted on the specimen to confirm the mechanical properties due to contact. The experimental results and the results of contact analysis simulation, reproducing the contact condition using the nonlinear finite element method, are reported.

Keywords: Truss, contact structure, deformation restraining members

1 Introduction

Truss structures have spread rapidly with the development of railroads since the 19th century, and a variety of structural forms have been developed. The truss structure is a rational structure that resists the overall load by means of the axial compressive force and axial tensile force of each member. The structure is composed of many relatively slim members, creating a sense of continuity, rhythm, and delicacy. However, it is currently limited to certain forms such as the warren truss structure, and no new structural forms have been created. This paper proposes a new core truss structure (hereinafter referred to as the SCT structure) to extend the possibilities of truss structures. This structure differs from conventional truss structures in that a pair of tongs coupled upside down with panel point offset, allowing the structure to expand and contract in a way of changing its shape.

The results of the study are reported below.

2 Development of SCT Structure and Application to Bridges

2.1 SCT structure

The SCT structure consists of two pairs of diagonal members plus other two diagonal members which joined with the said two pairs of members by two panel points [1]. It is formed by a unit of two pairs