

## Unconventional Structural Forms in Pedestrian Bridge Design

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## Summary

Trends in pedestrian bridge design are going to overreach the simple idea of connecting point A and point B. As growing communities have sought to define and differentiate themselves, footbridge design has become an aesthetically pleasant way for communities or neighborhoods to create a landmark. Such bridges are incorporating more thoughtful designs, complex engineering, and elegant materials as civic revisionists look to pedestrian bridges to make a statement. In this context technological advances have helped architects and engineers celebrate bridges' structural forms. Computer-aided techniques in particular allow designers to create complex shapes and to investigate new structural systems and schemes often through a computational morphogenesis process.

Starting from these considerations, the paper first presents a review and discussion of recent realizations in the field of pedestrian bridges, calling into evidence how design is more and more requiring a multidisciplinary approach, involving the integration of architectural and engineering disciplines. This discussion drives the presentation of some examples that are given in the last section of the paper. In particular, a few examples of unconventional structural forms potentially implementing some of the most challenging concepts previously indicated, and suitable for the realization of pedestrian bridges are presented and discussed.

**Keywords:** pedestrian bridge design; free-form architecture; architecture - engineering integration; Memetic Algorithm; Virtual Force Density Method.

## 1. Introduction

Recent advances in computational technologies have mainly influenced the designer by allowing almost any kind of geometrical representation, including complex free-form shapes which are not practically manageable without these tools. As a consequence the growing range of projects involving unconventional forms and computational approaches is visible and the will to explore new possibilities is also increasing.

This scenario calls for new solutions, not only in the design of shapes but also in the design of structures and the context of bridge design is perhaps the one which makes this sentence more evident. As a matter of fact in the context of bridge design the structure is often “bare” and we can observe that its contribution to the final perception of the bridge is the most appreciable.

In this paper the focus is on pedestrian bridges, where the role of the structure is still predominant but, thanks to limited span and loads, it can today quite well cope with formal requirements. It is not a case that over the last decade the most innovative realizations have occurred in this field and not in the field of road bridges, where traditional structural schemes which are proved to be economically and statically effective are far to be replaced.