

FRAME WEIGHT MINIMIZATION

USING CHAOS THEORY AND

INTEGRATED APPROACH

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Building frames submitted to loads are analyzed considering nonlinear behavior created by related material properties of concrete and reinforcing steel. An effective method of optimizing the mass distribution throughout these structures was studied taking these particular conditions into account.

A predesign technique was investigated leading to initial sizing of reinforced concrete building frames. The objective is to determine values of adequate areas of frame elements that maximize the energy dissipated when loading is present. The distribution is based in some simple notions of chaos theory. To guarantee anticipated acceptance of the frame performance some safety and serviceability constraints were also considered.

The element reliability was based on a failure function considering the flexural forces at the element and system level. The system reliability was dependent upon the probability of failure of the flexural collapse mechanisms. Optimization was performed using the integrated approach including global displacements as design variables together with element sizing variables. The optimization strategy is based on the generalized reduced gradient method.