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Abstract

In this theoretical study, the optimal design of constant thickness, fibre-reinforced slabs carrying a specified system of applied forces is investigated. The aim of the optimization process is to minimise the weight of the reinforcing fibres; the density and layout of the reinforcement being determined by this criterion.

The analytical treatment of minimum weight design for a linear cost function is considered in Chapters 4 to 6. Plasticity theory is used to determine the slab strength. The optimum design of beams and slabs continuous over several supports is discussed in Chapter 4. The optimal placing of supports to transmit a given load is then studied in Chapter 5, and a near-optimum design method for complex slab structures is outlined in Chapter 6.

The weight-bending relationship for reinforced concrete slabs is not quite linear. It is shown in Chapter 7 that a non-linear representation of the cost function is better. It is found that there is a strong similarity between the elastic stress distribution for a constant thickness homogeneous plate and the optimum plastic stress distribution. The effect of linearisation of the cost function is assessed, and the degree of its accuracy is indicated. The optimum design of a slab with a given reinforcement pattern is also discussed Several worked examples are presented to illustrate the suggested procedures.

The post-yield stiffness of slabs sometimes gives rise to concern; in such cases optimization may increase the sensitivity to imperfections. [illegible] haviour of both optimally and non-optimally designed slabs is [illegible] Chapter 8. By comparing the post-yield behaviour of two [illegible] that the influence of strain-hardening and changes in [illegible] carrying capacity are more beneficial in the case [illegible]