

*Plane Strain of a Net Formed by Inextensible Cords**

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1. Introduction. In this paper we consider the mechanics of a plane net formed by two families of parallel inextensible cords. We assume that, in the undeformed state of the net, the cords are straight. We assume also that the cords are perfectly flexible and thin in comparison with the distance between adjacent cords of a family, and that the deformation is such that when the net is deformed no two cords of a family are brought into contact. Furthermore, we assume that intersecting cords of the two families cannot move relative to each other at their points of intersection, as a result of the deformation. Such a net provides an idealisation of certain types of textile fabric.

The scope of the present paper is restricted to plane deformations of the net, although it is intended in a later paper to discuss the mechanics of the deformation when this restriction is removed[†]. It will be appreciated that, in certain cases, the predicted deformations, although kinematically and statically possible, may nevertheless not be realised because of their instability.

In Secs. 2 and 3, we consider the pure homogeneous deformation of a sheet of the ideal fabric and it is shown that, as a result of the constraints imposed by the inextensibility of the cords, the principal directions for the pure homogeneous deformation bisect the angles between the cords.

In Sec. 4 it is shown that, for a general plane deformation of the sheet, the displacements undergone by the various points of the sheet must satisfy differential equations of the hyperbolic type[‡].

In the subsequent sections it is shown how these equations may be solved for

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† It appears that certain geometrical aspects of the latter problem have been discussed by TCHEBICHEF (C. R. Ass. Française pour l'Avancement des Sciences, 7^e session, p. 154 (1878)). I have not been able, however, to find more than a brief abstract of his work.

‡ See also, A. Voss, Math. Ann. **19**, 1 (1882).