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Orthogonal grids around convex bodies using foliations

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SUMMARY

A new technique for the construction of orthogonal grids around convex bodies is presented. The method, which is analytical or numerical depending on how the body boundary is expressed, is based on the development of geometric foliations that follow a prescribed direction (for instance, the prevailing direction of flow) around convex bodies of arbitrary shape. The construction of these foliations is straightforward and does not require the solution of any system of algebraic or differential equations, nor the use of iterative procedures. The method is applicable both to two- and three-dimensional domains since it is based solely on the concept of local curvature. The lines or surfaces given by the foliations of first and second order, together with the complementary orthogonal lines, respectively, define the orthogonal two- or three-dimensional grids. Copyright © 2002 John Wiley & Sons, Ltd.

KEY WORDS: orthogonal grids; grid generation; foliation; submerged convex body

1. INTRODUCTION

The numerical simulation of many flows of engineering interest requires the construction of grids around bodies of arbitrary shape. This is the case, for instance, of the study of the flow and transfer processes around obstacles protruding from a solid wall or around solid bodies submerged in bounded or unbounded flow domains. Usual requirements for the construction of these grids are that (i) they should be boundary-fitted so that co-ordinate lines progressively closer to the body match its shape, (ii) follow the direction of the moving fluid and (iii) far

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