计算几何中几何偏微分方程的构造 *1)

徐国良

(LSEC, 中国科学院, 数学与系统科学研究院, 计算数学研究所, 北京 100080)

张 琴

(LSEC, 中国科学院, 数学与系统科学研究院, 计算数学研究所, 北京 100080;

北京信息科技大学, 基础课教学部, 北京 100085)

摘 要

平均曲率流、曲面扩散流和 Willmore 流等著名的几何流除了在理论方面有重要的意义之外, 在计算机辅助几何设计、计算机图形学以及图像处理等领域也得到了广泛的应用. 然而在解决实际问题时, 人们经常要根据问题的特点构造其它具有指定性质的几何流. 本文从统一的观点出发, 对于参数曲面以及水平集曲面, 给出了几类重要几何偏微分方程(包括L^2梯度流、H^{-1}梯度流以及H^{-2} 梯度流)的构造. 这几类几何流的包容十分广泛, 上述提到的几个几何流均为其特例.

关键词: 计算几何, 能量泛函, 梯度下降流, 欧拉–拉格朗日算子

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CONSTRUCTION OF GEOMETRIC PARTIAL DIFFERENTIAL EQUATIONS IN COMPUTATIONAL GEOMETRY

Xu Guoliang

(*LSEC, Institute of Computational Mathematics, Academy of Mathematics and System Sciences, Chinese Academy of Sciences, Beijing 100080, China*)

Zhang Qin

(*LSEC, Institute of Computational Mathematics, Academy of Mathematics and System Sciences, Chinese Academy of Sciences, Beijing 100080, China;*
Department of Basic Courses, Beijing Information Science and Technology University, Beijing 100085, China)

Abstract

It is well-known that mean curvature flow, surface diffusion flow and Willmore flow have played important roles in the field of geometry analysis. They are also widely used in the fields of computer aided geometric design, computer graphics and image processing. However, in the real applications one often needs to construct various different flows according to the specific requirements of the problems to be solved. In this paper, we propose

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a generic framework for constructing geometric partial differential equations, including L^2, H^{-1} and H^{-2} gradient flows. These flows are general, which contain mean curvature flow, surface diffusion flow and Willmore flow as their special cases.

Keywords: computational geometry, energy functional, gradient descent flow, Euler–Lagrange operator

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1. 引　　言

几何流作为一类重要的几何偏微分方程 ....[1]

2. 预备知识

本节概述下文中用到的符号和基本知识 ....

3. 参数曲面的梯度下降流

首先考虑一个经典的极小化问题 ....

参 考 文 献

[1] Jin J M. The Finite Element Method in Electromagnetics[M]. Wiley-IEEE Press, New York, 2014.