Pattern formation on evolving biological surfaces : the surface finite element method applied to reaction-diffusion systems

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The Evolving Surface Finite Element Method (ESFEM) will be presented. This is a numerical method developed by Dziuk and Elliott [2] to solve a class of non-linear partial differential equations on surfaces, that may evolve in time. The key idea is based on the approximation of the surface by a triangulated surface consisting of a union of triangles with vertices on the original surface. The ESFEM has shown efficiency and great flexibility when it comes to the equation it can approximate and the surfaces it can handle. We will show how we can apply it to the pattern formation, by solving appropriate reaction-diffusion systems, on evolving surfaces that may have some biological meaning. We will present some applications such as the simulation of pattern formation on the skin of a growing organism and the growth of solid tumours.
We will also present some results on the reaction-diffusion systems with cross-diffusion-driven instability.

References

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