Inreasing the rate of convergence to steady-state by using multiple penalties applied in a domain

Hannes Frenander and Jan Nordström.

Department of Mathematics

Division of Computational Mathematics, Linköping University

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Introduction

- We consider a finite difference approximation with summation-by-parts operators and weakly imposed boundary conditions.
- The boundary conditions are imposed with the simultaneous approximation terms (SAT).
- Given a well-posed problem, the numerical approximation is made stable with appropriate choices of penalty terms.

Introduction

- The method has been extended to cover a close-boundary domain,

  where the solution is assumed to be known.

Introduction

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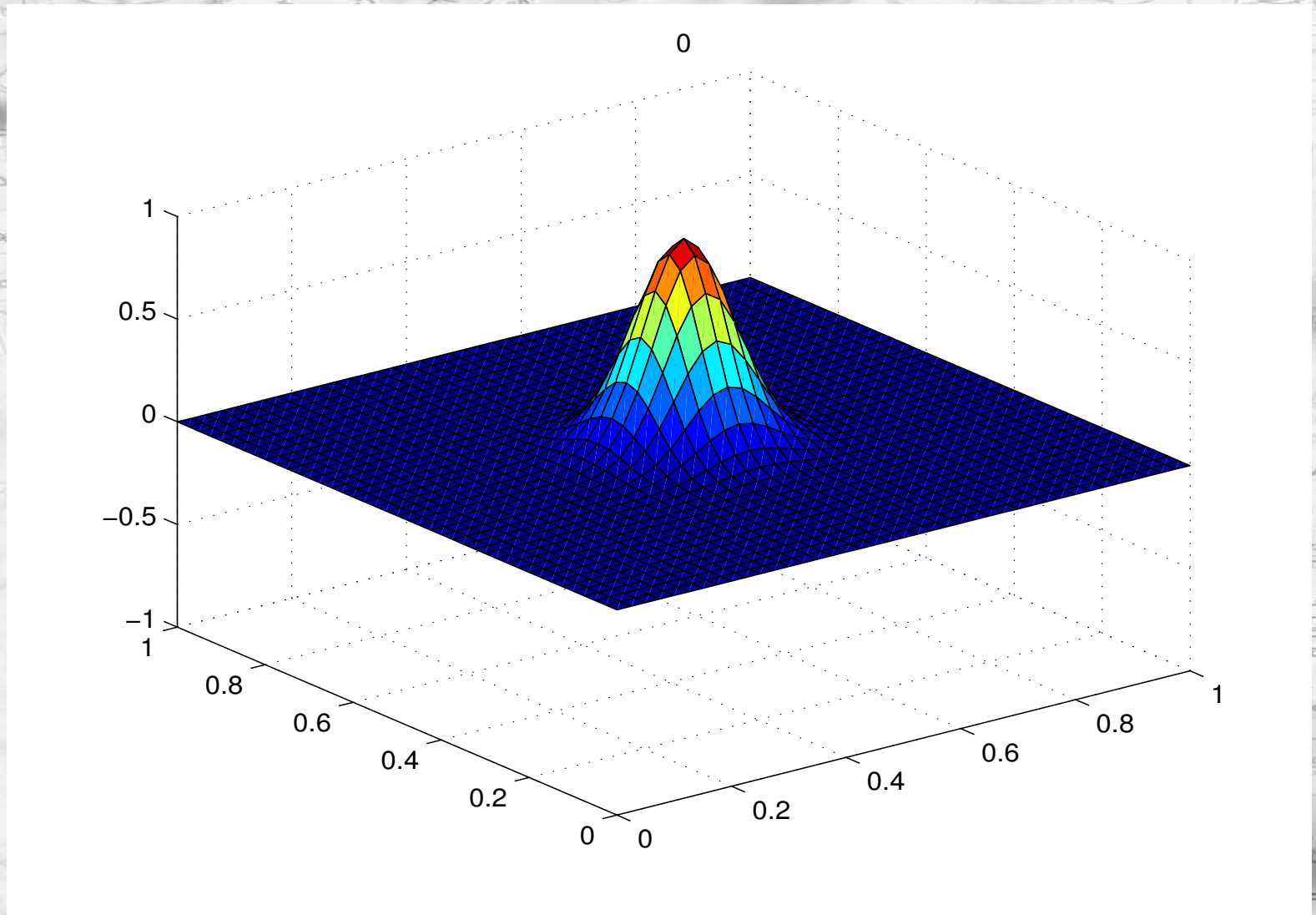
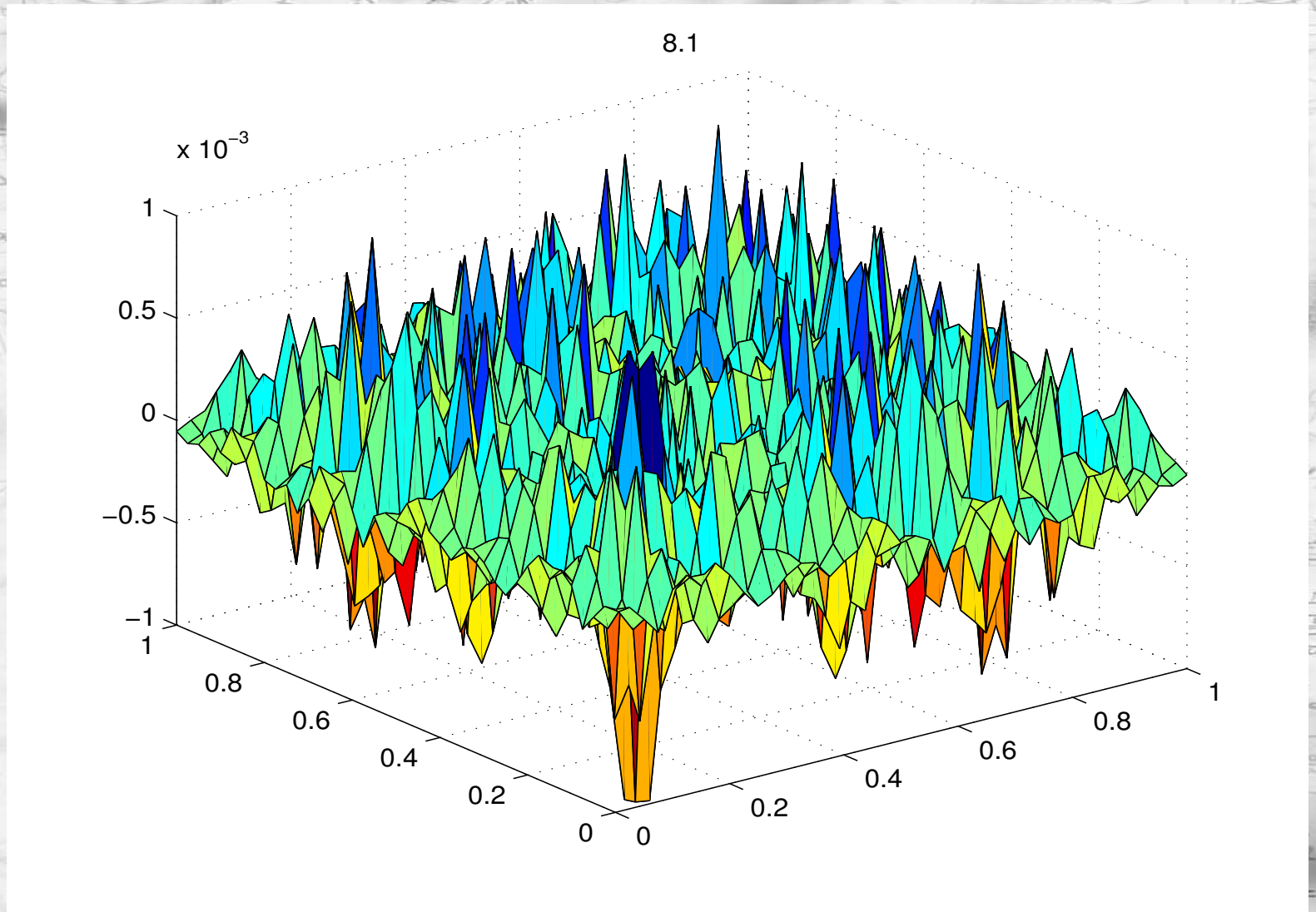
- The multiple penalty technique adds flexibility to the scheme.
- Stability can easily be guaranteed.
- Straight-forward to implement and generalize to multiple dimensions.
- Puts new demands on the knowledge of the problem: the solution needs to be known in the extended domain.

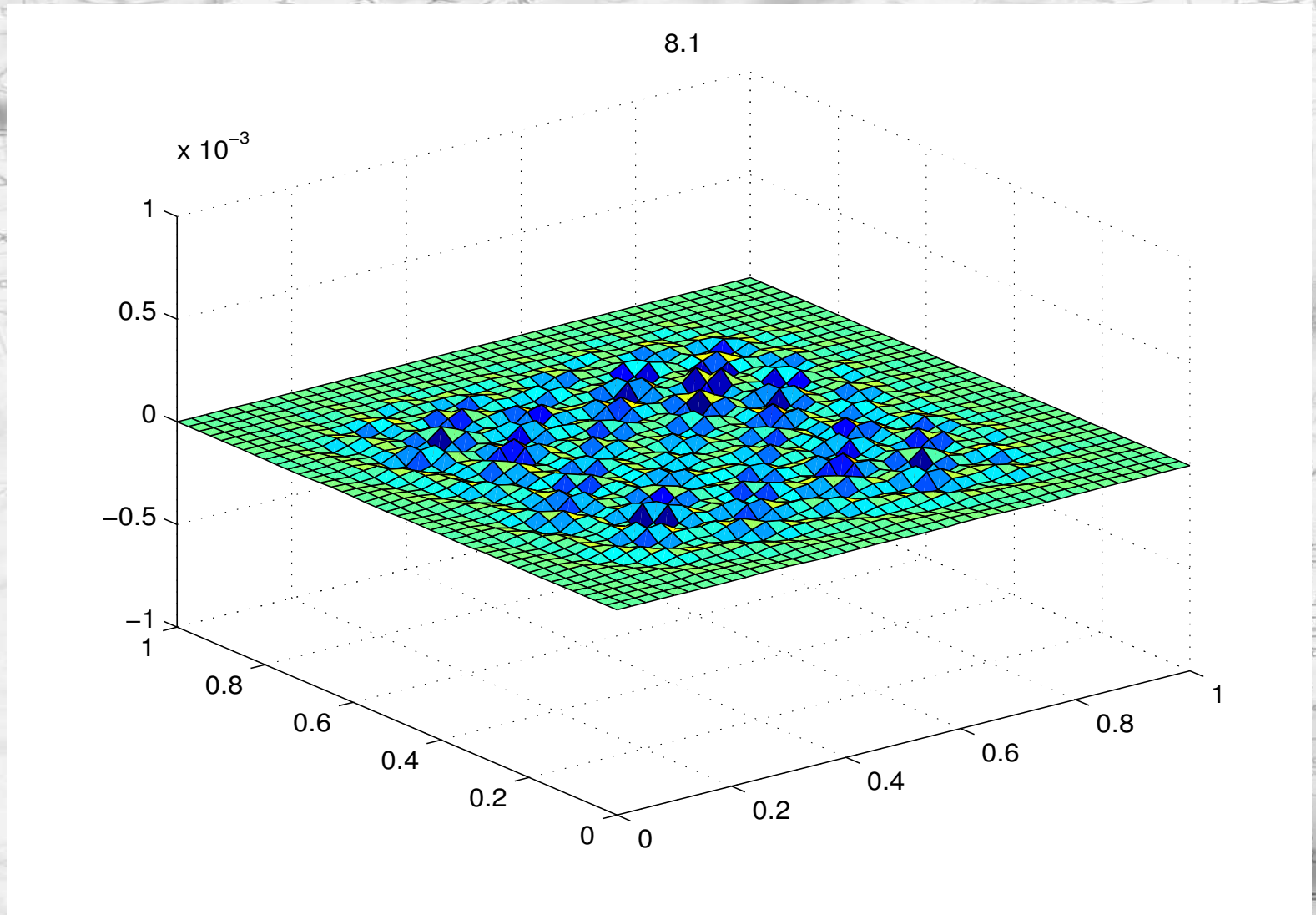
Results



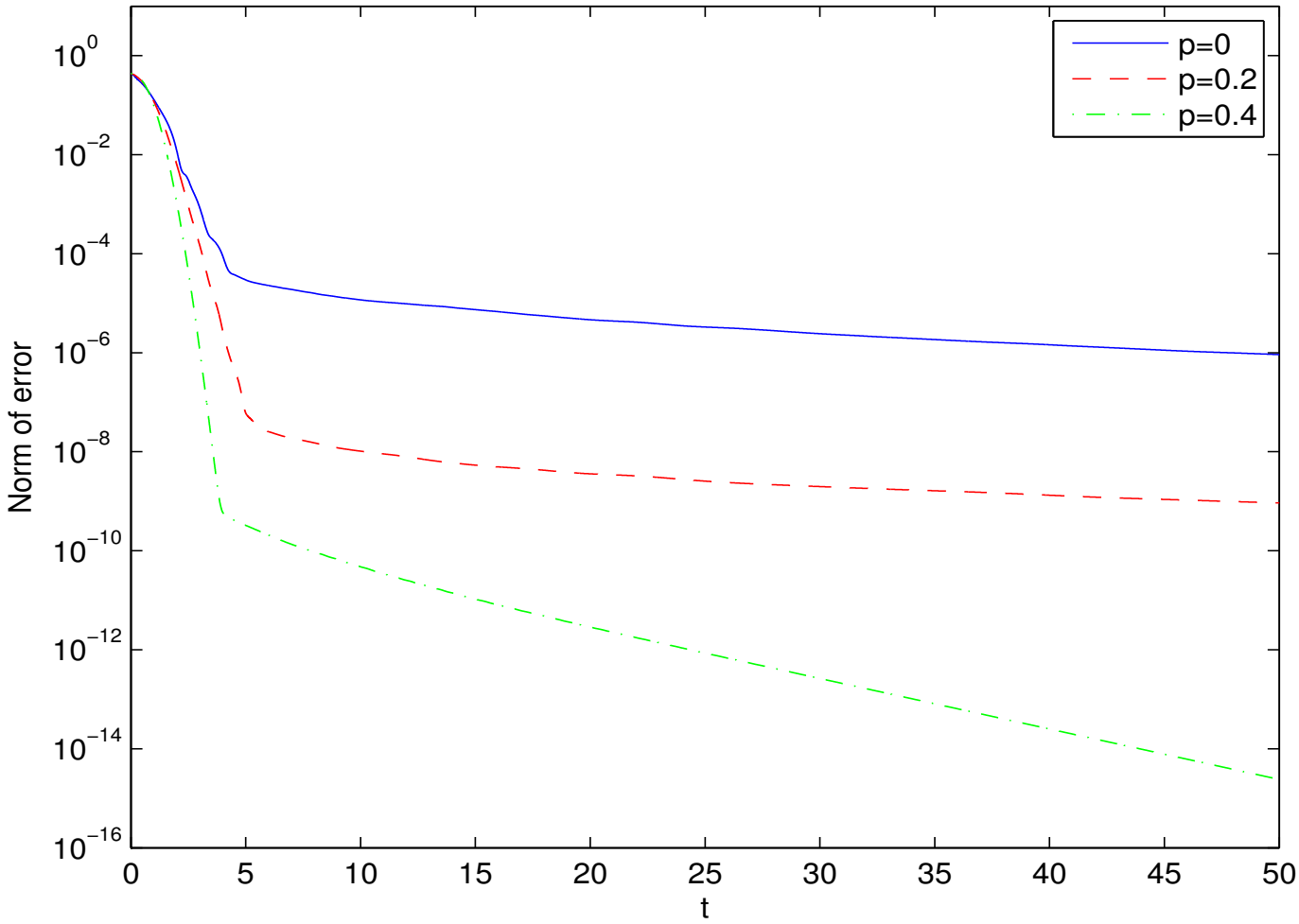
Results



Results



Results


p=0
p=0.2
p=0.4
Norm of error
t
10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-12}
10^{-14}
10^{-16}
0
5
10
15
20
25
30
35
40
45
50