广东省计算数学学会计算科学前沿论坛

为了推动广东省计算数学学科发展，促进省内外计算数学工作者的交流与合作，加强计算数学与相关交叉学科的融合，广东省计算数学学会举办计算科学前沿论坛，定期聘请领域内专家开展讲座，介绍计算科学的前沿发展方向，分享最新研究成果，欢迎广大专家、青年学者及研究生参与。

论坛首期讲座嘉宾为北京大学杨超教授、华南理工大学潘少华教授。

时间：2020 年 9 月 5 日（周六）上午 9:00 至 11:00

参会方式：腾讯会议 ID：295 893 074

欢迎大家参加！

广东省计算数学学会

2020 年 8 月 31 日

报告一：杨超教授（时间 9:00-10:00）

报告题目：A Penalty-Free Neural Network Method for Solving a Class of Second-Order Boundary-Value Problems on Complex Geometries

报告摘要：In this talk, we present PFNN, a penalty-free neural network method, to efficiently solve a class of second-order boundary-value problems on complex geometries. To reduce the smoothness requirement, the original problem is reformulated to a weak form so that the evaluations of second-order derivatives are avoided. Two neural networks, rather than just one, are employed to construct the approximate solution, with one network satisfying the essential boundary conditions and the other handling the rest part of the domain. In this way, an unconstrained optimization problem, instead of a constrained one, is solved without adding any penalty terms. The entanglement of the two networks is eliminated with the help of a length factor function that is scale invariant and can adapt with complex geometries. We prove the convergence of the PFNN method and conduct numerical experiments on a series of linear and nonlinear second-order boundary-value problems to demonstrate that PFNN is superior to several existing approaches in terms of accuracy, flexibility and robustness. Some recent attempts on enabling the parallel computing capability of the PFNN method are also briefly introduced in this talk.

报告人简介：杨超，北京大学数学科学学院教授、科学与工程计算中心副主任，教育部“长江学者”特聘教授，北京智源人工智能研究院“智源学者”。长期致力于大规模并行计算相关的模型、算法、软件和应用研究，发表论文 80 余篇。研究成果曾先后获 2012 年中国科学院卢嘉锡青年人才奖、2016 年美国计算机学会“戈登·贝尔”奖（ACM Gordon Bell Prize）、2017 年中国科学院杰出科技成就奖、2017 年 CCF-IEEE CS 青年科学家奖等。目前担任中国科学院软件研究所学术/学位委员会委员，中国工业与应用数学学会“高性能计算与数学软件”专业委员会副主任兼秘书长，中国计算数学学会常务理事，中国新一代人工智能产业技术创新战略联盟“AI 指令集与开发接口”标准专题组组长等职务。

报告二：潘少华教授（时间 10:00-11:00）

报告题目：A proximal MM method for the zero-norm regularized PLQ composite optimization problem

报告摘要：This study is concerned with a class of zero-norm regularized piecewise linear-quadratic (PLQ) composite optimization problems, which covers the zero-norm regularized \ell_1-loss minimization problem as a special case. For this class of nonconvex nonsmooth and non-Lipschitz optimization problems, we show that its equivalent MPEC reformulation is partially calm on the set of global optima and make use of this property to derive a family of equivalent DC surrogates. Then, we propose a proximal majorization-minimization (MM) method, a convex relaxation approach different from the DC algorithms, for solving one of the DC surrogates, a two-block nonsmooth semiconvex PLQ optimization problem. For this method, we establish its global convergence and linear rate of convergence, and show that under mild conditions the limit of the generated sequence is not only a local minimum but also a good critical point in a statistical sense. Numerical experiments are conducted with synthetic and real data for the proximal MM method with the subproblems solved by a dual semismooth Newton method to confirm our theoretical findings, and numerical comparisons with a convergent indefinite-proximal ADMM for the partially smoothed DC surrogate verify its superiority in the quality of solutions and computing time.

报告人简介：潘少华，华南理工大学数学学院教授、博士生导师。现任中国运筹学会理事和中国运筹学会数学规划分会常务理事。研究方向：锥约束优化及互补问题、低秩稀疏优化问题的理论与算法研究。主持国家自科基金和广东省自科基金各 2 项。在国内外重要优化刊物 Mathematical Programming, SIAM Journal on Optimization, SIAM Journal on Control and Optimization, Computational Optimization and Applications 等杂志发表论文 30 余篇。相关研究成果获得广东省自然科学二等奖。