prove that SMD, without the use of mini-batch, is guaranteed to converge to a stationary point in a convergence rate of $\mathcal{O}(1/\sqrt{t})$. The efficiency estimate matches with existing results for stochastic subgradient method, but is evaluated under a stronger stationarity measure. This appears to be the first non-asymptotic convergence analysis of SMD for solving relatively weakly convex problems.

■ Iterative Methods

Room: **B131** (10:15 - 11:45) Chair: *Mahmoud Rawashdeh*

1. On Monotone Non-expansive Mapping and Their Approximation Fixed Point Results

Buthinah Bin Dehaish[1,*]

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Suppose that C is a nonempty closed bounded and convex subset of a metric space X. Let T be a monotone nonexpansive mapping on C. During this talk we will present some existence fixed point result of this mapping. Furthermore, we will describe the behavior of its fixed point by using some constructive iteration.

2. Tropical Optimization Problems: Recent Results and Applications Examples

Nikolai Krivulin[1,*]

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We consider multidimensional optimization problems formulated in the tropical mathematics setting to minimize or maximize functions defined on vectors over idempotent semifields, subject to linear equality and inequality constraints. We start with a brief overview of known tropical optimization problems and solution approaches. Furthermore, some new problems are presented with nonlinear objective functions calculated using multiplicative conjugate transposition of vectors, including problems of Chebyshev approximation, problems of approximation in the Hilbert seminorm, and pseudo-quadratic problems. To solve these problems, we apply methods based on the reduction to the solution of parametrized inequalities, matrix sparsification, and other techniques. The methods offer direct solutions represented in a compact explicit vector form ready for further analysis and straightforward computation. We conclude with a short discussion of the application of the results obtained to practical problems in location analysis, project scheduling and decision making.

3. Applying the Fractional Natural Decomposition Method to Solve Fractional Differential Equations in Multi-dimensional Space

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In recent years, interest in the fractional differential equations has been stimulated due to their wide applications in various fields of engineering and science. Various vital phenomena in electromagnetic, viscoelasticity, fluid mechanics, electrochemistry, biological population models, and signal processing are well described by fractional differential equations. Also, they are employed in social sciences such as food supplement, climate, finance, and economics. As a result, the importance of obtaining exact or approximate solutions of fractional linear and nonlinear differential equations in physics and applied mathematics is still a significant problem that needs new methods.
We propose a new method called the inverse fractional natural transform method (IFNTM). We present theoretical results and apply them to obtain approximate solutions of linear fractional ordinary differential equations (LFODEs) and partial differential equations (LFPDEs). The fractional derivatives are described in the Caputo sense. The algorithm described in this study is expected to be further employed to solve similar linear problems in fractional calculus.

■ Applications in Healthcare

Room: **B023** (10:15 - 11:45) Chair: *Secil Sozuer*

1. Kinetic Parameter Identification Based on Spectroscopic Data - advancements Illustrated by Case Studies

Christina Schenk[1,*], *Lorenz T. Biegler*[1], *Lu Han*[2], *Jason Mustakis*[2]

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The development of drug manufacturing processes involves dealing with spectroscopic data. When dealing with spectroscopic data, the identification of parameters and variances still remains a challenging task. In many cases kinetic parameter identification from spectroscopic data has to be performed without knowing the absorbing species in advance, such that they have to be estimated as well. However, kinetic parameter estimation is important in order to lower production costs, i.e. save measurements and equipment. Furthermore, scaling up from laboratory to industrial level relies on accurate kinetic parameter values. That is why, we take a closer look at the development of optimization-based procedures in order to estimate the variances of the noise in the system variables and spectral measurements. Then, with the estimated variances we determine the concentration profiles and kinetic parameters simultaneously using adequate strategies. The work is based on the approach proposed by [1] using maximum likelihood principles for simultaneous estimation of reaction kinetics and curve resolution from process and spectral data. For this a new software environment was developed which is continuously enhanced. These investigations and advancements are presented within this talk and illustrated by several case studies of pharmaceutical processes.
References [1] W Chen, LT Biegler, and SG MuÃśoz. An approach for simultaneous estimation of reaction kinetics and curve resolution from process and spectral data. Journal of Chemometrics, 30:506âĂŞ522, 2016.

2. A Further Study on the Opioid Epidemic Dynamical Model with Random Perturbation

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In this talk, we consider an opioid epidemic dynamical model with random perturbation that describes the interplay between regular prescription use, addictive use, and the process of rehabilitation from addiction and vice-versa. In particular, we provide two-sided bounds on the solution of the density function for the Fokker-Planck equation that corresponds to the opioid epidemic dynamical model, when the random perturbation enters only through the dynamics of the susceptible group in the compartmental model. Here, the proof for such two-sided bounds basically relies on the interpretation of the solution for the density function as the value function of a certain optimal stochastic control problem. Finally, as a possible interesting development in this direction, we also provide an estimate for the attainable exit