stochastic ordering policy by observing inventory levels, backorders, shipments, demand history, and the Markov state. This study advances data-driven supply chain optimization, demonstrating how reinforcement learning can adapt to dynamic uncertainties, offering a scalable alternative to rule-based inventory policies.

■ TA-35

Tuesday, 8:30-10:00 - Room: Michael Sadler LG15

Nonlinear Optimization Algorithms and Applications: 4

Stream: Continuous and mixed-integer nonlinear programming: theory and algorithms
Invited session
Chair: *Ya-xiang Yuan*
Chair: *Zaikun Zhang*
Chair: *Xin Liu*
Chair: *Cong Sun*

1 - A multilevel stochastic regularized first-order method with application to training
Margherita Porcelli, Filippo Marini, Elisa Riccietti

We present a new multilevel stochastic framework for the solution of optimization problems. The proposed approach uses random regularized first-order models that exploit an available hierarchical description of the problem, being either in the classical variable space or in the function space, meaning that different levels of accuracy for the objective function are available. We present the converge analysis of the method and show its numerical behavior on the solution of finite-sum minimization problems arising in binary classification problems.

2 - Complexity of trust-region methods in the presence of unbounded Hessian approximations
Youssef Diouane, Mohamed Laghdaf Habiboullah, Dominique Orban

We extend traditional complexity analyses of trust-region methods for unconstrained, possibly nonconvex, optimization. Whereas most complexity analyses assume uniform boundedness of the model Hessians, we work with potentially unbounded model Hessians. Boundedness is not guaranteed in practical implementations, in particular ones based on quasi-Newton updates such as PSB, BFGS and SR1. Our analysis is conducted for a family of trust-region methods that includes most known methods as special cases. We examine two regimes of Hessian growth: one bounded by a power of the number of successful iterations, and one bounded by a power of the number of iterations.

When the model Hessians grow as \$mathcalO(kp)\$, where \$k\$ is the iteration counter and \$0 le p le 1\$, we derived a sharp \$mathcalO(epsilon2/(1p))\$ worst-case evaluation complexity bound to reach an \$epsilon\$-stationary point. Additionally, for the case where \$p = 1\$, we established a new \$mathcalO(exp(cepsilon2))\$ worst-case evaluation complexity bound, for some constant \$c > 0\$. We derived similar sharp bounds when the model Hessians grow linearly with the number of successful iterations. Among others, our results confirmed the profound intuition of Powell on complexity for multiple quasi-Newton approximations.

3 - A new SLP algorithm applied to Topology Optimization
Luis Felipe Bueno, Ernesto G. Birgin, Dimary Moreno, Tiara Martini Santos, Thiago Santos, Thadeu Senne

In this work we present a globally convergent version of a Sequential Linear Programming (SLP) algorithm and illustrate its numerical performance in Topology Optimization problems. The theoretical part of the work is based on recent advances in identifying key elements for the globalization of constrained nonlinear programming methods. The computational experiments focus on the application of Topology Optimization in which we are interested in building a structure in order to minimize a certain objective, respecting some necessary physical properties. Using a finite element scheme, the problem can be written as a nonlinear integer programming problem, for which we consider a continuous relaxation using the solid isotropic material with penalization strategy.

4 - Subsampled Trust-Region Methods with Deterministic Worst-Case Complexity Guarantees
Geovani Grapiglia

In this work, we develop and analyze subsampled trust-region methods for solving finite-sum optimization problems. These methods use random subsampling strategies to approximate the gradient and Hessian of the objective function, thereby significantly reducing the overall computational cost. However, the sample size for gradients (or gradients and Hessians) is chosen deterministically, with the notable feature that a full sample size maybe never required. We establish deterministic worst-case iteration complexity bounds for obtaining approximate first and second-order stationary points. Finally, numerical experiments illustrate the promising performance of the proposed algorithms.

■ TA-38

Tuesday, 8:30-10:00 - Room: Michael Sadler LG19

Forecasting, prediction and optimization 1

Stream: Data Science meets Optimization
Invited session
Chair: *Vittorio Maniezzo*

1 - A Hierarchical Approach to Forecasting Censored Demand in Lost-Sales Systems
Diego José Pedregal Tercero, Juan Ramon Trapero Arenas

Accurate demand forecasting is critical for inventory management, especially in lost-sales systems where stockouts lead to unobservable demand. Traditional forecasting models relying solely on sales data systematically underestimate demand, resulting in biased forecasts and suboptimal inventory policies. To address this, we propose an extension of the Tobit Exponential Smoothing (TETS) model that integrates temporal hierarchies to enhance demand estimation across different time frequencies. This approach leverages state-space models to reconcile high-frequency data (e.g., hourly sales) with lower-frequency demand forecasts (e.g., daily replenishments). By capturing censoring constraints at multiple aggregation levels, our method significantly reduces forecasting bias and improves the estimation of demand variance—crucial for defining safety stock. Through simulated case studies and a real-world dataset from the M5 competition, we demonstrate that our model outperforms conventional exponential smoothing and Tobit-based methods, leading to lower lost sales and excess inventory. Additionally, we analyze the spiral-down effect, where naïve forecasting approaches exacerbate stockouts over time, and show how our method mitigates this issue. The results highlight the practical advantages of temporal hierarchies for demand forecasting, offering a robust, theoretically grounded framework for inventory optimization in supply chain management.

2 - Estimating True Demand Under Stockouts and Interruptions: A Hybrid Tobit Kalman Filter and Conformal Prediction Approach
Harsha Halgamuwe Hewage, Bahman Rostami-Tabar, Aris Syntetos

Accurate demand estimation is critical for family planning supply chain management, particularly in contexts where stockouts and operational disruptions frequently lead to censored demand observations. Standard forecasting models often fail to capture true demand due to lost sales. In this study, we propose a hybrid Tobit Kalman Filter and conformal prediction framework to reconstruct true demand by correcting censored observations. We model demand as a state-space system incorporating baseline level, trend, seasonality, and a dynamic