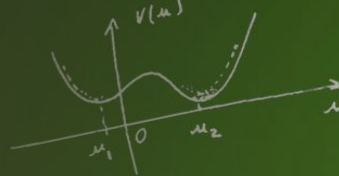


1. The Euler-Lagrange eq.

Real time Risk Management of Multi-Asset and Multi-Currency

Risk Management

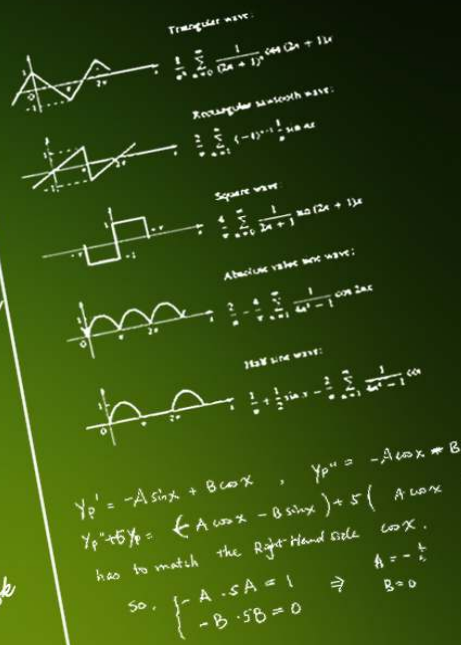
Consider the ode $\frac{du}{dt} = -V'(u)$. What can we say about the asymptotic (i.e. as $t \rightarrow +\infty$) dynamics?
 $\frac{dV}{du} \frac{du}{dt} = V'(u) (-V'(u)) = -[V'(u)]^2 \leq 0$.
 Along trajectories of the ode and if $V'(u) \neq 0$, we expect u to "reach" a minimum of V .



- Depending on the initial condition, the asymptotic state may vary.
- We have assumed that $V(u)$ is well behaved.

Ability to perform "What if" analysis

Minimum Risk



Triangular wave: $\frac{1}{2} \sum_{n=1}^{\infty} \frac{1}{n^2} \cos(2n-1)x + 11x$

Rectangular smooth wave: $\sum_{n=1}^{\infty} \frac{1}{n^2} \cos(2n-1)x$

Square wave: $\frac{4}{\pi} \sum_{n=1}^{\infty} \frac{1}{2n-1} \sin(2n-1)x$

Absolute value wave: $\frac{2}{\pi} \sum_{n=1}^{\infty} \frac{1}{n^2} \cos(2n-1)x$

Half sine wave: $\frac{1}{2} \sum_{n=1}^{\infty} \frac{1}{n} \sin \frac{n}{2}x - \frac{1}{2} \sum_{n=1}^{\infty} \frac{1}{n} \cos \frac{n}{2}x$

$Y_p'' + 5Y_p = A \cos x + B \sin x$, $Y_p'' = -A \sin x + B \cos x$, $Y_p'' = -A \cos x + B \sin x$

has to match the Right Hand Side $\cos x$.
 So, $-A \cdot 5A = 1 \Rightarrow A = -\frac{1}{5}$
 $-B \cdot 5B = 0 \Rightarrow B = 0$

Identify | Measure | Control

We would like to extend these ideas to partial differential equations. If we have a functional $J(y)$ defined on a set of functions y , how can we make sense of a derivative of J ?

Result OK

characteristic eqn: $\lambda^2 + 5 = 0 \Rightarrow \lambda = \pm \sqrt{5}i$
 So, the homogeneous solution is $y_h = C_1 \cos(\sqrt{5}x) + C_2 \sin(\sqrt{5}x)$
 To find a particular solution Y_p , we guess the form of Y_p first, the undetermined coefficient.

INTRODUCTION

Risk Analysis and Management System is a pro-active, real-time solution that provides advanced analytics and quantification of risk for multi-asset and multi-currency portfolios. Enables the exchanges / clearing organizations to effectively identify and mitigate risks associated with traders' portfolios on real-time basis. Seamless integration with trading, clearing and other data sources for real-time monitoring of P&L and margin utilized with actual limits. RISKx offers transparent quantification of Margin based on Value at Risk, CME-SPAN® and thumb rule.

RISKx empowers the risk management team to analyse and predict the risk based on the historical movement and expected theoretical price of product and other parameters. It enables the stress testing of real-time portfolios based on customized parameters.



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Risk Management



VALUE PREPOSITION

- **LEAST USER INTERVENTION**

RISKx provides fault-tolerant, highly automated risk management measures ensuring real-time consolidation of position for margin and P&L computation of multi-asset and multi-currency products. It empowers the scheduling of multiple risk management activities to enable defining and automated execution of time-based risk activities of regular and pre-planned risk activities.

- **PROGRESSIVE AND INNOVATIVE SOLUTION**

RISKx offers sophisticated risk management tools having ability to integrate standalone analytical modules to multiple data sources from trading to settlement. It empowers real-time analysis of market volatility and margin computation before applying the modified volatility to market.

- **ADVANCED ANALYTICS AND ACCURACY**

RISKx offers most advanced and accurate statistical margin computation based on thumb rule, VaR methodology and CME-SPAN® methodology. Computation of P&L is empowered with multiple levels of customized parameters for monitoring the risk based on the market need. Pre-defined customized alerts mechanism for early warning bells to all stakeholders for taking preemptive manual / automated risk mitigation action based on highest level of accuracy.

- **COMPATIBILITY**

RISKx offers seamless integration with other systems such as Trading, Clearing and other systems to receive and disseminate real-time information. Real-time information from other systems enables dynamic monitoring and mitigation of real-time risk arising at various stages of trade life-cycle.

- **SMARTER DECISION-MAKING**

RISKx enables to perform 'What if' analysis by juggling among various risk factors determining the risk such as volatility, price, etc. RISKx has Stress-testing capability with flexible 'what if' scenarios to analyze the impact of specific events on a client's risk profile for smarter decision-making.

- **FLEXIBILITY AND LOW-LATENCY**

RISKx provides highly flexible and unified connectivity with ability to evaluate the impact of explicit events on the traders' risk profile such as proposed trades or anticipated price changes. RISKx, through its innovative risk management measures enables processing of huge number of transactions with ultra-low-latency. Load distribution mechanism enables the risk management to balance the load of entity-wise positions having position in multiple assets.

HIGHLIGHTS

- Real-time Risk Management of Multi-Asset and Multi-Currency
- Seamless Integration with trading, clearing and other data sources
- Margin Computation based on customized thumb - rule margins, Value-at-Risk based model and CME SPAN®
- P&L and Margin-based Alerts including reverse alerts
- Event-based update of member status
- Risk Management at Account-level
- Ability to perform 'What if' analysis
- Real-time Square-off at product and member-level
- Greeks and Implied Volatility details
- Theoretical price computation based on multiple models including Black Scholes
- Margin benefit to members for mitigating the risk based on intra-commodity, inter-commodity with multi-tier positions
- Extensive value-added reports to provide data to third party reporting software (Data Warehouse)
- Real-time interim settlement of products

ARCHITECTURE

