Krishnarao D Dhuri, PhD

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OBJECTIVE

Having strong background in Mechanical engg., advanced domains like controls, signal processing, dynamical systems, condition monitoring, optimization, operations research and want to work on challenging problems.

CAREER OVERVIEW

- Professional with over 10 years of diverse industry experience in executing/leading research programs, solving business critical field issues, putting-down research road map, algorithms.
- In-depth understanding about technology areas like Controls-estimation, Prognostics & health monitoring, Optimization, Signal-processing, Meta-modeling, Statistics, etc.
- Strong experience in physics based and data-based system modeling and analysis
- Experience of comprehending complex phenomena from data

INTERESTS

- Controls, signal processing, dynamical systems, Condition monitoring, data analytics, optimization etc.

INDUSTRIAL EXPERIENCE

Associate Professor at CMR Institute of Technology, Dept. of Mechanical engg (08/2014 - Current)

- Taught PG courses - 'Advanced Theory of Vibrations', 'Design Optimization', 'Theory of plates and shells', 'Smart materials and structures' and 'Experimental stress analysis'.
- PG coordinator for Mechanical engg.; member of 'College Research & Industrial Interaction Committee', instrumental in signing MoU with 'SKF' and 'Enlivening Technologies Pvt. Ltd' for research collaboration.
- Working on consultancy project from GE - Wind turbine controls and wind farm optimization.
- Guiding PhD student on 'Condition monitoring and determination of remaining useful life (RUL) of rolling element bearings using data driven techniques'.

Lead Engineer at GE Global research – Controls and Optimization lab (01/2008 - 07/2014)

- Worked mainly with Wind energy and Transportation businesses, with significant contribution to GE products/services – Locomotive - AC4, WindOPTIONS®, WindLayout®
- Contributed significantly to GE Wind energy on programs - Wind farm controls, Wind farm micrositing optimization, mechanical loads model, tools for Upgrades suggestions.

  1. Wind farm control: Co-ordinated wind farm control for more energy yield. Worked with team on devising control strategies/architecture. Limitations of sensors have overcome using soft-sensing – wind speed and direction estimation using real time data. Developed the algorithms for wind-speed and wind-direction estimation. It is validated with field data. Worked on optimization problem to enable real-time implementation. Worked on wind turbine loads model for wind farm controls platform. Field data analyzed to improve the models.

  2. Wind farm micrositing optimization: A tool for identifying turbine locations and turbine type for more energy yield. Led the program for development of features like- optimization for LCoE minimization, Number, layout and product mix optimization together. Improved algorithms for faster convergence. Shown significant speed improvement (50X) with optimized hybrid algorithms and parallelization over multi-core machines. Improved speed performance demonstrated running it on CPU-GPU platform. Worked with business to carve-out research road-map for micrositing tools.

  3. Upgrade optimizer: Optimizer for selecting service offerings - controller based (peak shaver, wind boost) and hardware (blade-tip extension, vortex generators) for existing farms. A typical case, 50 odd service combinations for ~200 turbines farm efficiently solved using integer problem algorithms. A conceptual design, usage of SCADA data for upgrades suggestion is proposed.

  4. Mechanical loads model: Efficient and quite accurate (+/-3%) loads model has been developed from high-fidelity Wind turbine model. Challenge of computational time is sorted out by meta-model based adaptive sampling and appropriate static sampling with sensitivity studies. This model enabled series of customer services like WindOPTIONS, a tool to identify GE wind turbine for new market.

5. Involved in other research activities like - blade heath monitoring using wireless sensors and energy harvesting devices, dynamic braking to minimize extreme loads in the event of grid-loss.

- Worked with GE-Transportation for improving traction performance of locomotives in adhesion limited condition. Solved traction related issues after analyzing field data.
  1. Development of AC4 locomotive, where only 4 out of 6 axles will be powered by AC motors to improve cost-margin and reliability. The challenge was performance in adhesion-limited (wet tracks, snow-falling areas) conditions. An innovative idea of transferring the weight from un-powered to powered is proposed, which helps for improving the tractive performance in such conditions. Model-based controller is developed for managing the weight in real time. A controls model is developed for normal forces on each axle. Model is validated with test data. Also, new concepts like dual-spring are introduced. Optimization of these springs and reliability of new design is showed running DOE. The control strategy is implemented on locomotives and the product is in field for last four years.

  2. On research front, tested semi-active suspension (MR damper) for locomotives for improving traction in simulation. Also, developed HIL simulator for the same. Worked on conceptual design of light weight passenger locomotives for Asian markets.

Assistant System Engineer at EACoE (A GE-TATA JV) - Gas Turbines (02/2002 – 03/2003)
- Finite element analysis for gas turbine combustors. Development and tuning of 1-D models of Gas turbines combustors using field data.
- Six-Sigma Green-belt certification

Graduate Trainee Engineer at Mahindra & Mahindra (07/1999 – 06/2000)
- Hands on experience of fatigue testing of various tractor components on MTS and Instron machines and proposed design modifications as a part of R&D activities. Used field data for identifying representative loading during testing.
- Field-testing of tractors and shop-floor experience

PhD RESEARCH SUMMARY
- Proposed *minimal natural frequency change* as an additional consideration for optimal sizing/placement of piezoelectric sensors/actuators for active vibration control
- Proposed evolutionary optimization approach for placement of piezoelectric sensors/actuators for active vibration control
- Derived simple, ready-to-use expressions for natural frequencies of a cantilever beam under axial tensile load

EDUCATION
- **PhD** in **Mechanical Engineering** (Smart structures)**, IIT Bombay**(2003- 2007)
  Dissertation title: "Optimal sizing and placement of piezoelectric sensors/actuators for active vibration control of flexible structures"
- **M.Tech** in **Mechanical Engineering**, **IIT Kharagpur** (2000-2002)
  Dissertation title: "Dynamic analysis of axially moving web"
- **B.E.** in **Mechanical Engineering**, **Govt**. **College of Engg**, **Karad**, **Shivaji University** (1996-1999)
  Dissertation title: "Experimental stress analysis of compressor component"

SKILLS
- Expertise in controls, estimation, optimization, condition monitoring. Good understanding about statistical methods. Experience of developing the products from scratch.
- Softwares**:** Matlab/Simulink, ADAMS, LabVIEW, dSPACE, Python, R. Optimization solvers like IPOPT, CPLEX, TOMLAB

PATENTS
- Systems and methods providing variable spring stiffness for weight management in a vehicle (Patent Application # 239163(551-009))
- Coordinated wind farm control for enhancing energy yield and noise management (Application filed)
- Vibration reduction of washing machine using magnetic bearings (Disclosure in process)

- GPU computing for wind farm micrositing, a large scale optimization problems (Disclosure in process)
- Wind turbine upgrades selection using SCADA data (Disclosure in process)

JOURNAL PUBLICATIONS

- **Dhuri, K.D.** and Seshu, P., Piezo actuator placement and sizing for good control effectiveness and minimal change in original system dynamics, *Smart Materials & Structures*, 15, 1661-1672 (2006)
- Seshu, P. and **Dhuri, K.D.**, Corrected formulae for natural frequencies of a cantilever beam under uniform axial tension, *AIAAJ*, 45(6), 1435-1438 (2007)
- **Dhuri, K.D.** and Seshu, P., Favorable locations for piezo actuators in plates with good control effectiveness and minimal change in system dynamics, *Smart Materials & Structures*, 16 2526-2542 (2007)
- **Dhuri, K.D.** and Seshu, P., Multi-objective optimization of piezo actuator placement and sizing using genetic algorithm, *Journal of Sound and Vibration*, 323 (3) 495-514 (2009)

CONFERENCE PUBLICATIONS

- Jain, V., **Dhuri, K.D.**, Seshu, P. and Seth, B., Development of servo driven four-bar mechanism for constant speed application, *Proc. of 9th IFToMM Int. Conf. on Theory of Machines And Mechanisms*, Bucharest, Romania, September 1 - 4, 2005, 53-58
- **Dhuri, K.D.** and Seshu, P., Active vibration control of flexible-link manipulators using piezoelectric sensors and actuators, *Proc. of 3rd Int. Conf. on Autonomous Robots and Agents 2006*, December 12-14, 2006, Palmerston North, New Zealand, 93-98
- **Dhuri, K.D.** and Seshu, P., Position control of flexible parallelogram five-bar manipulator using piezoelectric sensors and actuators, *Proc. of IFToMM 2007 (Mechatronics section)*, June 17 - 21, Besançon, France
- **Dhuri, K.D.** and Seshu, P., Active vibration control of flexible manipulators using piezoelectric sensors and actuators, National Conf. On Adv. in Structures and Materials in Association with ACCE &ICI, Bangalore, April 2015

ACHIEVEMENTS/ EXTRA-CURRICULAR ACTIVITIES

- Management awards for successful programs- WindOPTIONS®, WindLAYOUT®, Wind farm Control, ASAP®, AC4 field support at GE
- First prize for Industry Defined Problem (Mahindra-Tractor) at RADIANCE' 2007 at IIT Bombay
- Reviewer for original articles submitted for peer review to SAEINDIA – *Int. Mobility Engg. Congress & Exposition, 2009* and iNaCoMM 2013.
- IEEE member

REFERENCES Available upon request