
Ulf Jakob Flø Aarsnes

Head of Research and Development, Solgt.no |
Senior Researcher, Norwegian Research Centre

Briskebyveien 11A | 0271 Oslo
Cell: +47 93459291
ulfjakob@gmail.com

Education

Ph.D., Engineering Cybernetics (2012-2015) **Norwegian University of Science and Technology**
Dissertation: *Modeling of Two-Phase Flow for Estimation and Control of Drilling Operations*
Advisor: Professor Ole Morten Aamo (NTNU) and Professor Glenn Ole Kaasa (NTNU, Kelda).
Major Field: Systems and Control

M.S.E., Engineering Cybernetics (2007-2012) **Norwegian University of Science and Technology**
Thesis: *Reduced Order Observer Design for Managed Pressure Drilling*
Advisor: Professor Ole Morten Aamo (NTNU) and Dr. Alexey Pavlov (Statoil).
Major Field: Systems and Control

Visiting Scholar (2010-2011) **University of California, Berkeley**
Department: *Electrical Engineering and Computer Science*

Experience

Solgt.no AS – Oslo, Norway Jun 2021 – Present
Head of Research and Development
NORCE Norwegian Research Centre AS – Oslo, Norway Jan 2018 – Present
Senior Researcher & Marie Skłodowska-Curie Action (MSCA) Fellow
MINES ParisTech – Paris, France March 2019 – Feb 2020
Visiting Researcher
University of California San Diego – La Jolla, CA, USA Jan 2018 – February 2019
Visiting Researcher
International Research Institute of Stavanger – Oslo, Norway Jan 2016 – Dec 2017
Post Doc
MINES ParisTech – Paris, France May 2013 – Jun 2013 & Oct 2016 – Dec 2016
Visiting Researcher
Blade Energy Partners – Frisco, TX, USA Oct 2015 – Nov 2015
Secondment
The University of Texas at Austin – Austin, TX, USA May 2014 – Nov 2014
Visiting Researcher
Statoil – Porsgrunn, Norway Feb 2013 – Apr 2013
Research Internship

Research Interests

Theory: Machine Learning, Control and Estimation, Optimization, Data Science.
Applications: Real estate, Energy systems, Business Optimization

Publications

1352 citations, h-index = 26 ([Google scholar](#), Apr. 2023)

Journal Papers

[J1] U. J. F. Aarsnes, M. S. Gleditsch, O. M. Aamo, and A. Pavlov, "Modeling and Avoidance of Heave Induced Resonances in Offshore Drilling," *SPE Drill. Complet.*, vol. 29, no.04, pp. 454-464, Dec. 2014.

- [J2] U. J. F. Aarsnes and O. M. Aamo, “Linear stability analysis of self-excited vibrations in drilling using an infinite dimensional model,” *J. Sound Vib.*, vol. 360, pp. 239–259, Jan. 2016.
- [J3] U. J. F. Aarsnes, F. Di Meglio, R. Graham, and O. M. Aamo, “A Methodology for Classifying Operating Regimes in Underbalanced Drilling Operations,” *SPE J.*, vol. 21, no.02, Apr. 2016.
- [J4] A. Ambrus, U. J. F. Aarsnes, A. Karimi Vajargah, B. Akbari, E. van Oort, and O. M. Aamo, “Real-Time Estimation of Reservoir Influx Rate and Pore Pressure Using a Simplified Transient Two-Phase Flow Model for Managed Pressure Drilling Operations,” *J. Nat. Gas Sci. Eng.*, vol. 32, pp. 439–452, 2016.
- [J5] U. J. F. Aarsnes, B. Acikmese, A. Ambrus, and O. M. Aamo, “Robust Controller Design for Automated Kick Handling in Managed Pressure Drilling”. *J. of Process Control*, vol. 47, pp. 46–57, Nov. 2016.
- [J6] U. J. F. Aarsnes, A. Ambrus, F. Di Meglio, A. Karimi Vajargah, E. van Oort, and O. M. Aamo. “A Simplified Two-Phase Flow Model Using a Quasi-Equilibrium Momentum Balance”. *Int. J. of Multiph. flow*, vol. 83, pp 77-85, Mar. 2016.
- [J7] U. J. F. Aarsnes, T. Flåtten, and O. M. Aamo, “Review of two-phase flow models for control and estimation,” *Annu. Rev. Control*, vol. 42, pp. 50–62, Jul. 2016.
- [J8] A. Nikoofard, U. J. F. Aarsnes, T. A. Johansen, and G.O. Kaasa, “State and Parameter Estimation of a Drift-Flux Model for Underbalanced Drilling Operations,” *IEEE Trans. Control Syst. Technol.*, pp. 1–10, 2017.
- [J9] T. Pedersen, U. J. F. Aarsnes, and J. M. Godhavn, “Flow and pressure control of underbalanced drilling operations using NMPC”. *J. of Process Control*, 68, 73–85. 2018.
- [J10] U. J. F. Aarsnes and R. J. Shor, “Torsional vibrations with bit off bottom: Modeling, characterization and field data validation,” *J. Pet. Sci. Eng.*, vol. 163, pp. 712–721, Apr. 2018.
- [J11] U. J. F. Aarsnes and N. van de Wouw, “Dynamics of a distributed drill string system: Characteristic parameters and stability maps,” *J. Sound Vib.*, vol. 417, pp. 376–412, Mar. 2018.
- [J12] Auriol, U. J. F. Aarsnes, P. Martin, and F. Di Meglio, “Delay-robust control design for heterodirectional linear coupled hyperbolic PDEs,” *IEEE Trans. Automat. Contr.*, vol. 63, no. 10, pp. 3551–3557, Sep. 2018.
- [J13] U. J. F. Aarsnes, and A. Busch, “Transient modeling of one-dimensional solid-liquid flow in conduits,” *Int. J. of Multiph. flow*, 105(August), 102–111. 2018.
- [J14] U. J. F. Aarsnes, F. Di Meglio, and R. J. Shor, “Avoiding stick slip vibrations in drilling through startup trajectory design”. *J. of Process Control*, 70, 24–35. 2018.
- [J15] U. J. F. Aarsnes and N. van de Wouw, “Axial and torsional self-excited vibrations of a distributed drill-string,” *J. Sound Vib.*, vol 444, pp. 127-151, Mar. 2019.
- [J16] U. J. F. Aarsnes and N. van de Wouw, “Effect of shock subs on self-excited vibrations in drilling systems,” *J. Pet. Sci. Eng.*, vol. 181, p. 106217, Oct. 2019.
- [J17] U. J. F. Aarsnes, J. Auriol, F. Di Meglio, and R. J. Shor, “Estimating friction factors while drilling,” *J. Pet. Sci. Eng.*, vol. 179, pp. 80–91, Aug. 2019.
- [J18] F. Di Meglio, P. Lamare, and U. J. F. Aarsnes, “Robust output feedback stabilization of ODE-PDE-ODE interconnection,” *Automatica*, vol. 119, 2020.
- [J19] J. Auriol, R. J. Shor, U. J. F. Aarsnes, and F. Di Meglio, “Closed-loop toolface control with the bit off-bottom,” *J. of Process Control*, 90, 35–45. 2020.
- [J20] J. Auriol, U. J. F. Aarsnes, F. Di Meglio, R. Shor, “Robust control design of underactuated 2×2 PDE-ODE-PDE systems,” *IEEE Contrl Syst. Letters*, vol. 5, no. 2, pp. 469–474. 2020.
- [J21] U. J. F. Aarsnes, A. Ambrus, F. Di Meglio, L. Gerbaud “A phenomenological transient model of bit foundering,” *Journal of Petroleum Science and Engineering* 199, 108299. 2021.
- [J22] T. Strecker, U. J. F. Aarsnes “Boundary Control and Estimation for Underbalanced Drilling With Uncertain Reservoir Parameters,” *IEEE Transactions on Control Systems Technology*, vol. 31, no. 1, pp. 281–294. 2022

- [J23] P. M. Nüsse, A. Ambrus, U. J. F. Aarsnes, O. M. Aamo “Evaluation of distributed damping subs with active control for stick–slip reduction in drilling,” *Geoenergy Science and Engineering*, vol. 231, Part A, 212255. 2023
- [J24] J. Shi, U. J. F. Aarsnes, D. Nærheim, S. Moura, “Online energy management system for a fuel cell/battery hybrid system with multiple fuel cell stacks,” *Submitted*. 2023

Conference Proceedings

- [C1] I. S. Landet, H. Mahdianfar, U. J. F. Aarsnes, A. Pavlov, and O. M. Aamo, “Modeling for MPD Operations With Experimental Validation,” in *IADC/SPE Drilling Conference and Exhibition*, 2012.
- [C2] U. J. F. Aarsnes, O. M. Aamo, and A. Pavlov, “Quantifying Error Introduced by Finite Order Discretization of a Hydraulic Well Model,” in *Australian Control Conference*, 2012, pp. 54–59.
- [C3] U. J. F. Aarsnes, O. M. Aamo, E. Hauge, and A. Pavlov, “Limits of Controller Performance in the Heave Disturbance Attenuation Problem,” in *Control Conference (ECC), 2013 European*, 2013, pp. 1070–1076.
- [C4] U. J. F. Aarsnes, F. Di Meglio, O. M. Aamo, and G.-O. Kaasa, “Fit-for-Purpose Modeling for Automation of Underbalanced Drilling Operations,” in *SPE/IADC Managed Pressure Drilling & Underbalanced Operations Conference & Exhibition*, 2014.
- [C5] F. Di Meglio, D. Bresch-Pietri, and U. J. F. Aarsnes, “An Adaptive Observer for Hyperbolic Systems with Application to Under Balanced Drilling,” in *IFAC World Congress 2014, South Africa*, 2014, pp. 11391–11397.
- [C6] U. J. F. Aarsnes, H. Mahdianfar, O. M. Aamo and A. Pavlov. “Rejection of Heave-Induced Pressure Oscillations in Managed Pressure Drilling,” presented at the *Colloquium on Nonlinear Dynamics and Control of Deep Drilling Systems*, Minneapolis, Minnesota, May 2014. (Invited Paper).
- [C7] U. J. F. Aarsnes, F. Di Meglio, S. Evje, and O. M. Aamo, “Control-Oriented Drift-Flux Modeling of Single and Two-Phase Flow for Drilling,” in *Proceeding of the ASME 2014 Dynamic Systems and Control Conference*, 2014.
- [C8] F. Di Meglio and U. J. F. Aarsnes, “A distributed parameter systems view of control problems in drilling,” in *2nd IFAC Workshop on Automatic Control in Offshore Oil and Gas Production*, 2015.
- [C9] A. Nikoofard, U. J. F. Aarsnes, T. A. Johansen and G.-O. Kaasa, “Estimation of States and Parameters of Drift-Flux Model with Unscented Kalman Filter,” in *2nd IFAC Workshop on Automatic Control in Offshore Oil and Gas Production*, 2015.
- [C10] U. J. F. Aarsnes, A. Ambrus, A. Karimi Vajargah, O. M. Aamo, and E. Van Oort, “A Simplified Gas-Liquid Flow Model for Kick Mitigation and Control During Drilling Operations,” in *Proceeding of the ASME 2015 Dynamic Systems and Control Conference*. **ASME Energy Systems Best Paper Award Finalist**
- [C11] A. Ambrus, U. J. F. Aarsnes, A. Karimi Vajargah and E. van Oort, “A Simplified Transient Multi-Phase Model for Automated Well Control Applications,” in *9th International Petroleum Conf. (IPTC)*, 2015.
- [C12] U. J. F. Aarsnes, E. Hauge and J.-M. Godhavn, “Mathematical Modeling of Gas in Riser,” in *SPE Deepwater Drilling & Completions Conf.*, 2016.
- [C13] U. J. F. Aarsnes, and N. van de Wouw, “Axial and torsional dynamics of a distributed drill string system,” at *European Nonlinear Dynamics Conference (ENOC)*, 2017.
- [C14] U. J. F. Aarsnes and R. J. Shor, “Stick-slip and torsional friction factors in inclined wellbores,” in *MATEC Web of Conferences*, 2018.
- [C15] P.-O. Lamare, J. Auriol, F. di Meglio, and U. J. F. Aarsnes, “Robust output regulation of 2×2 hyperbolic systems: Control law and Input-to-State Stability,” in *American Control Conference (ACC)*, 2018.
- [C16] U. J. F. Aarsnes, F. Meglio, and R. J. Shor, “Benchmarking of Industrial Stick-Slip Mitigation Controllers,” in *IFAC Workshop on Automatic Control in Offshore Oil and Gas Production*, 2018.
- [C17] R. J. Shor, U. J. F. Aarsnes and F. Di Meglio, “Effects of latency, motor inertia and filtering on stick-slip mitigation control”, presented at the *Colloquium on Nonlinear Dynamics and Control of Deep Drilling Systems*, Stavanger, Norway, May 2018. (Invited Paper).

- [C18] F. Di Meglio, U. J. F. Aarsnes, and R. J. Shor, “Advances in control of Hyperbolic Partial Differential Equations: opportunities for drilling”, presented at the *Colloquium on Nonlinear Dynamics and Control of Deep Drilling Systems*, Stavanger, Norway, May 2018. (Invited Paper).
- [C19] U. J. F. Aarsnes, O. M. Aamo and M. Krstic, “Extremum seeking for real-time optimal drilling control”, in *American Control Conference (ACC)*, 2019.
- [C20] U. J. F. Aarsnes, R. Vazquez, F Di Meglio and M. Krstic. “Delay robust control design of under-actuated PDE-ODE-PDE systems”, in *American Control Conference (ACC)*, 2019.
- [C21] P. Pastusek, G. Payette, R. Shor, E. Cayeux, U. J. F. Aarsnes, et al., “Creating Open Source Models, Test Cases, and Data for Oilfield Drilling Challenges” in *SPE/IADC International Drilling Conference and Exhibition*, 2019.
- [C22] J. Auriol, U. J. F. Aarsnes and R. Shor, “Self-Tuning Torsional Drilling Model for Real-Time Applications,” 2020 *American Control Conference (ACC)*, 2020, pp. 3091-3096
- [C23] J. Auriol, U. J. F. Aarsnes, F. Di Meglio and R. Shor, “Robust control design of underactuated 2×2 PDE-ODE-PDE systems,” in *59th IEEE Conference on Decision and Control (CDC)*, 2020.
- [C24] A. Ambrus, U. J. F. Aarsnes, E. Cayeux, R. Mihai “Modeling and Analysis of Non-Rotating Damping Subs for Removing Torsional Vibrations in Drilling,” in *International Conference on Offshore Mechanics and Arctic Engineering*, 2022.
- [C25] A. G. Aribowo, U. J. F. Aarsnes, E. Detournay, N. van de Wouw, N. Reimers. “Performance Analysis of a Downhole Regulator on Rate-Of-Penetration and Drilling Efficiency: An Autonomous Load Management at Bit.” in *SPE/IADC International Drilling Conference and Exhibition*, 2023

Selected Invited Talks

- AVM Workshop, NTNU Business School, Trondheim, Norway Feb 2024
- Department of Mechanical Engineering, Technische Universiteit Eindhoven, The Netherlands Mar 2019
- Geo-seminar, University of Minnesota, Minneapolis, MN, USA Feb 2019
- SoCal Control Workshop, UCLA, CA, USA Nov 2018
- Energy, controls and applications lab, UC Berkeley, CA, USA Sep 2016
- Department of Chemical and Petroleum Engineering, U. Calgary, Canada Sep 2016
- SPE Managed Pressure Drilling and Well Control Workshop, Rio, Brazil Jul 2015
- SINTEF Materials and Chemistry, Trondheim, Norway Nov 2014
- UT Austin Drilling Automation Group Nov 2014
- Blade Energy Partners, Frisco, TX, USA Jun 2014
- Servomøtet, Trondheim, Norway Oct 2013

Patents

United States Provisional Patent Appln No. 17/055,825 (Provisional application)

System and method for estimating distributed static and kinematic friction, torque and rpm along a drillstring in a wellbore
R. J. SHOR, F. Di Meglio and U. J. F. Aarsnes

Funding Awards and Project Management

Mobility stipend/ Marie Skłodowska-Curie Action (MSCA) Individual Fellowship Jan 2018 – Dec 2020

Project title: *Robust Estimation and Control of Infinite Dimensional Systems (RECIDS)*
Funding agency: *Norwegian Research Council, Marie Skłodowska-Curie actions.*
Role: *Project Manager*
Grant: *3,105,000 NOK*

SFI Center for Research-based Innovation

Dec 2020 – May 2021

Project title: *DigiWells - Digital Well Centre for Value Creation, Competitiveness, and Minimum Environmental Footprint*
Funding agency: *Norwegian Research Council, industry partners*
Role: *Work Package leader*
Grant: *(WP Budget 3,500,000 NOK per year)*

Innovation Project for the Industrial Sector (IP-N)

Jan 2022 – Dec 2024

Project title: *Decision support system for professional real-estate price estimation*
Funding agency: *Norwegian Research Council.*
Role: *Project Manager*
Grant: *9,700,000 NOK, (Total Budget 17,100,000 NOK).*

Collaborative and Knowledge-building Project (KSP)

Oct 2022 – Jun 2025

Project title: *Energy efficient operation of hydrogen powered vessels (HyEff)*
Funding agency: *Norwegian Research Council.*
Role: *Work Package leader*
Grant: *12,000,000 NOK, (WP budget 2.090.000 NOK)*

The Green Platform Initiative

Jan 2023 – Dec 2025

Project title: *Ocean Charger – maritim verdikjede for havvind med offshore energioverføring*
Funding agencies: *Norwegian Research Council, Innovation Norway and Siva.*
Role: *Work Package participant and Task leader*
Grant: *77,000,000 NOK (NORCE Budget 6,980,000 NOK)*

Teaching and supervision activities**Norwegian University of Science and Technology – Trondheim, Norway**

- Co-supervision of 2 PhD students (NTNU) 2021 –2025
- Co-supervision of 7 Master students (NTNU) 2013 –2024
- Examiner in course *Control Engineering* 2013
- Examiner in course *Engineering Cybernetics, Specialization Project.* 2013, 2014

Academic Service**Reviewer:**

- **Funding Agencies:**
 - Norwegian Research Council, *Innovation Project for the Industrial Sector (IP-N)*, Spring 2022, Fall 2022, Fall 2023
- **Journals:** IEEE Transactions on Control Systems Technology, Annual Reviews in Control, Brazilian Journal of Chemical Engineering, Journal of Sound and Vibration, Journal of Petroleum Science and Engineering, Journal of Process Control, International Journal of Robust and Nonlinear Control, Nonlinear Dynamics. Automatica, Meccanica, Transactions on Automatic Control.
- **Conferences:** IFAC Oilfield, European Control Conference (ECC), ASME Dynamics Systems and Control Conference, American Control Conference (ACC). IEEE Conference on Decision and Control (CDC). ASME International Conference on Ocean, Offshore and Arctic Engineering (OMAE).

Chairs and organizing:

- Co-Chair of Regular Session HG F5 on ‘Fluid Systems’, 2013 European Control Conference, Zurich, Switzerland.
- Organizer of the Fourth International Colloquium on “Non-linear dynamics and control of deep drilling systems”, Stavanger, Norway, May 2018.

Society Memberships:

- Norwegian Artificial Intelligence Research Consortium innovation network (NORA.startup) (2022 – present)
- Marie Curie Alumni Association (2021 – present)
- Society of Petroleum Engineers (2012 – 2021)