Beyond traditional sampling strategies for enhanced performance and cost-effectiveness

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Beyond Traditional Sampling Strategies for Enhanced Performance and Cost-Effectiveness
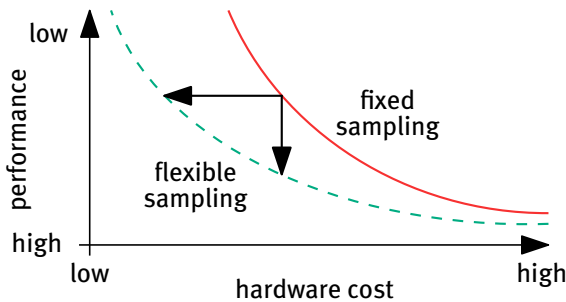
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Motivation

- Present: mainly fixed sampling (single-rate, equidistant) → well-developed control design framework
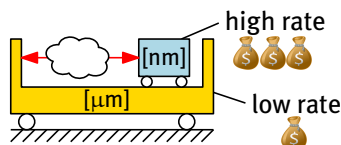- Problem: limited by performance/cost trade-off:

- Aim: break trade-off through flexible sampling
- Challenge: control design for systems with flexible sampling

Applications in motion control

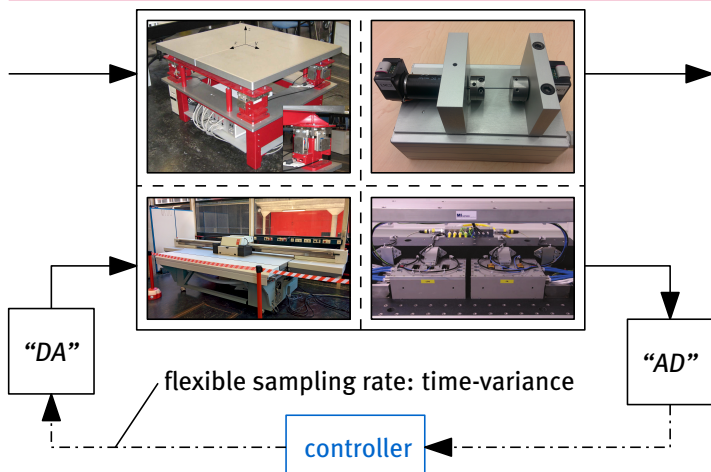- Examples of flexible sampling:
  - multi-rate control [1]

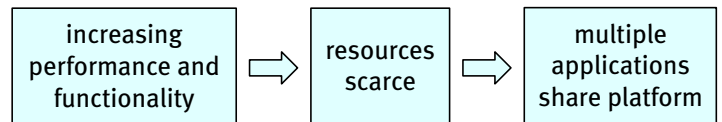 - non-equidistant sampling [2]


  - . . .

Unified framework for flexible sampling

flexible sampling rate: time-variance

Key contribution: various control algorithms for flexible sampling

Case study: FF for non-equidistant sampling

Motivation:

increasing performance and functionality ⇒ resources scarce ⇒ multiple applications share platform
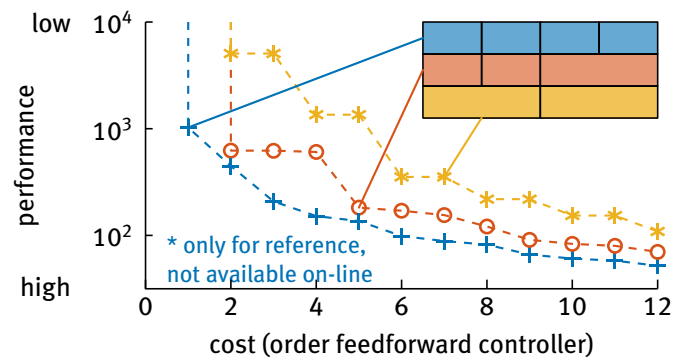
Tasks executed on same processor → requires scheduling → non-equidistant sampling of motion system
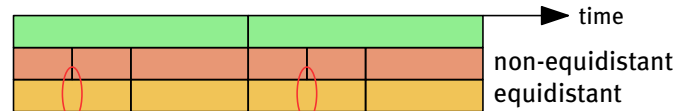
Two approaches for (feedforward) control design:
  I) settle with equidistant sampling rate ⇒ conservative
  II) design for non-equidistant rate → exploit additional design freedom to break the performance/cost trade-off:

* only for reference, not available on-line

Concluding remarks

General framework for
- modeling,
- identification, and
- control

of motion systems with flexible sampling

References

[1] J.C.D. van Zundert, J.L.C. Verhaegh, W.H.T.M. Aangenent, T. Oomen, D. Antunes and W.P.M.H. Heemels. "Feedforward for Multi-Rate Motion Control: Enhanced Performance and Cost-Effectiveness", *Proceedings of the 2015 American Control Conference*, 2831-2836, Chicago, IL, 2015.

[2] Jurgen van Zundert, Tom Oomen, Dip Goswami, and W.P.M.H. Heemels. "On the Potential of Lifted Domain Feedforward Controllers with a Periodic Sampling Sequence", *Proceedings of the 2016 American Control Conference*, Boston, MA, 2016.