

University of Groningen

## Model reduction for controller design for infinite-dimensional systems

Opmeer, Mark Robertus

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*  
2006

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Opmeer, M. R. (2006). *Model reduction for controller design for infinite-dimensional systems*. [Thesis fully internal (DIV), University of Groningen]. s.n.

**Copyright**

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

**Take-down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

*Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.*

# Summary

The main aim of this thesis is, as the title suggests, the presentation of results on model reduction for controller design for infinite-dimensional systems. These results are presented for discrete-time systems in Chapter 10 and for continuous-time systems in Section 14.7. They are perfect generalizations of the finite-dimensional results: we obtained existence and uniqueness of minimal LQG-balanced realizations under conditions that are obviously necessary (but it is far from obvious that they are sufficient!) and an error-bound for truncated LQG-balanced realizations. The results are illustrated by a controller design for a beam in Chapter 15.

Along the way we generalized several important theorems and introduced a few promising new concepts. Arguably the most important theorem that we generalize is that on the existence of (strongly) coprime factorizations. The results in Chapter 7 solve this long outstanding problem for which many partial results exist in the literature. The most important new concept resulting from this Ph.D. work is probably that of a (distributional) resolvent linear system. As shown in part II many systems described by partial differential equations fall into this class of systems *and* one can reasonably easily prove theorems for this class of systems. That this new concept brings together well-established concepts such as distribution semigroups, the Cayley transform and nonhomogeneous elliptic boundary value problems strengthens our belief that we have discovered an important new class of systems.

