



ABCDE



Scientific Report

First name / Family name

Jingjing/DU

Nationality

China

Name of the *Host Organisation*

NTNU

First Name / family name
of the *Scientific Coordinator*

Tor Arne/Johansen

Period of the fellowship

09/03/2013 to 08/03/2014



I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

I have been doing research on ‘integrated multimodel control of nonlinear systems’:

In short, the typical multimodel control design procedure is not very systematic, but rather problem dependent, and there is no close relationship between the determination of local linear models and the design of local linear controllers. Local models/controllers are handled *in parallel*. Unfortunately, in order to guarantee the global stability and robust performance, designers tend to use more local linear models than needed, which easily leads to linear local model redundancy, increases computational load, and complicates the following multimodel controller structure. If the local model/controller can be handled together, and the model selection and local controller design can be connected with each other (*i.e.* the multimodel decomposition and combination are integrated), the disadvantages of the traditional design procedure may be avoided.

In order to avoid linear model redundancy and simplify the structure of multimodel controller, we propose the general integrated multimodel control design framework, which integrates the multimodel decomposition and the multimodel combination of a nonlinear system, using on the gap metric and stability margin criteria. For a prescribed linear control algorithm for local controller design, a smaller and better set of local linear models that provide necessary information for multimodel controller design is obtained systematically without model redundancy. Besides, the local robust stability and performance of the system in each subregion can be achieved by the corresponding local controller. Many linear control methods can be used in the proposed design framework. H_∞ control algorithm has been employed as an example and applied to two benchmark nonlinear chemical processes for setpoint tracking and disturbance rejection control. Closed-loop simulations demonstrate that the proposed approaches are both systematic and effective and are better than the traditional multimodel control methods in terms of robust performance.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

- [1] Jingjing Du, Tor Arne Johansen, A gap metric based weighting method for multimodel predictive control of MIMO nonlinear systems, submitted to Journal of Process Control.
- [2] Jingjing Du, Tor Arne Johansen, Integrated multimodel control of nonlinear systems based on gap metric and stability margin, submitted to Industrial & Engineering Chemical Research.

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

I attended the ABCDE Seminar III in Athens from 31 OCT to 1 NOV 2013.

IV – RESEARCH EXCHANGE PROGRAMME (REP)

I visited the following two institutes during my fellowship:



Professor Schoukens Vrije Universiteit Brussel Johan.Schoukens@vub.ac.be
20-24/05/2013

Professor Celikovsky UTIA celikovs@utia.cas.cz
03-07/06/2013