Challenging in Instrument and Process Control on Oil and Gas Industry

# SISTEM KONTROL PREDIKTIF (MODEL PREDICTIVE CONTROL) SEBAGAI SALAH SATU ALTERNATIF SISTEM KONTROL PADA INDUSTRI MINYAK - GAS

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# Karakteristik Proses

Umumnya proses di industri memiliki karakteristik sebagai berikut :

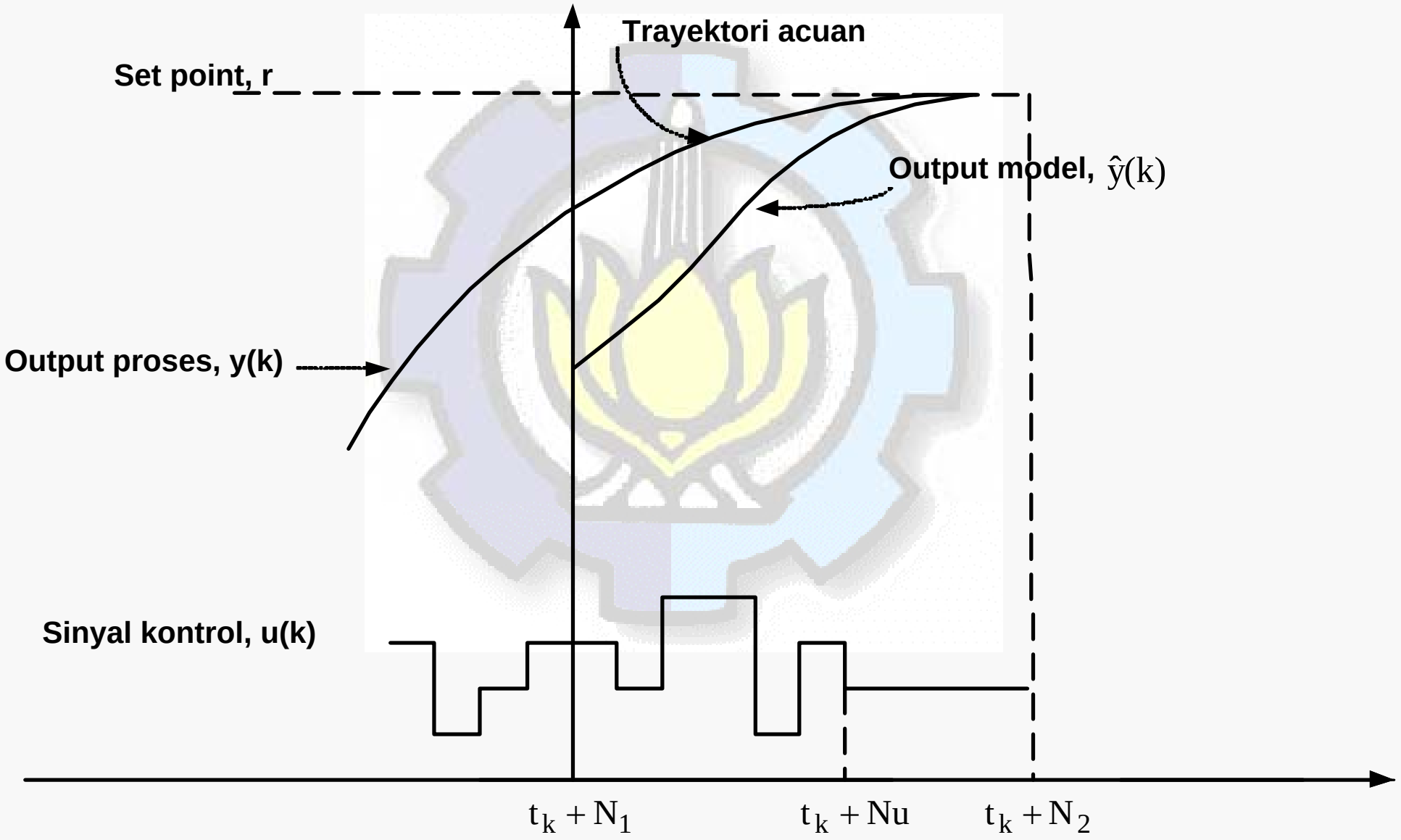
- Kompleks
- Nonlinier
- Memiliki waktu tunda
- Unstable open loop
- Nonminimum phase

# Sistem Kontrol Berbasis Model

Nonlinear model based control is an integrated approach for process analysis, control and optimization where the same steady state, nonlinear, process model is used at each stage. The use of this type of model to predict the control action required to meet the control objectives can be expected to provide improved performance over simple, linear models as the model gives more precise information about the effects of manipulated variables on the controlled variables.

*) Anshari R.M, Nonlinear Model Based Process Control – Applications in Petroleum Refining, Springer 2000

# Konsep Sistem Kontrol Prediktif



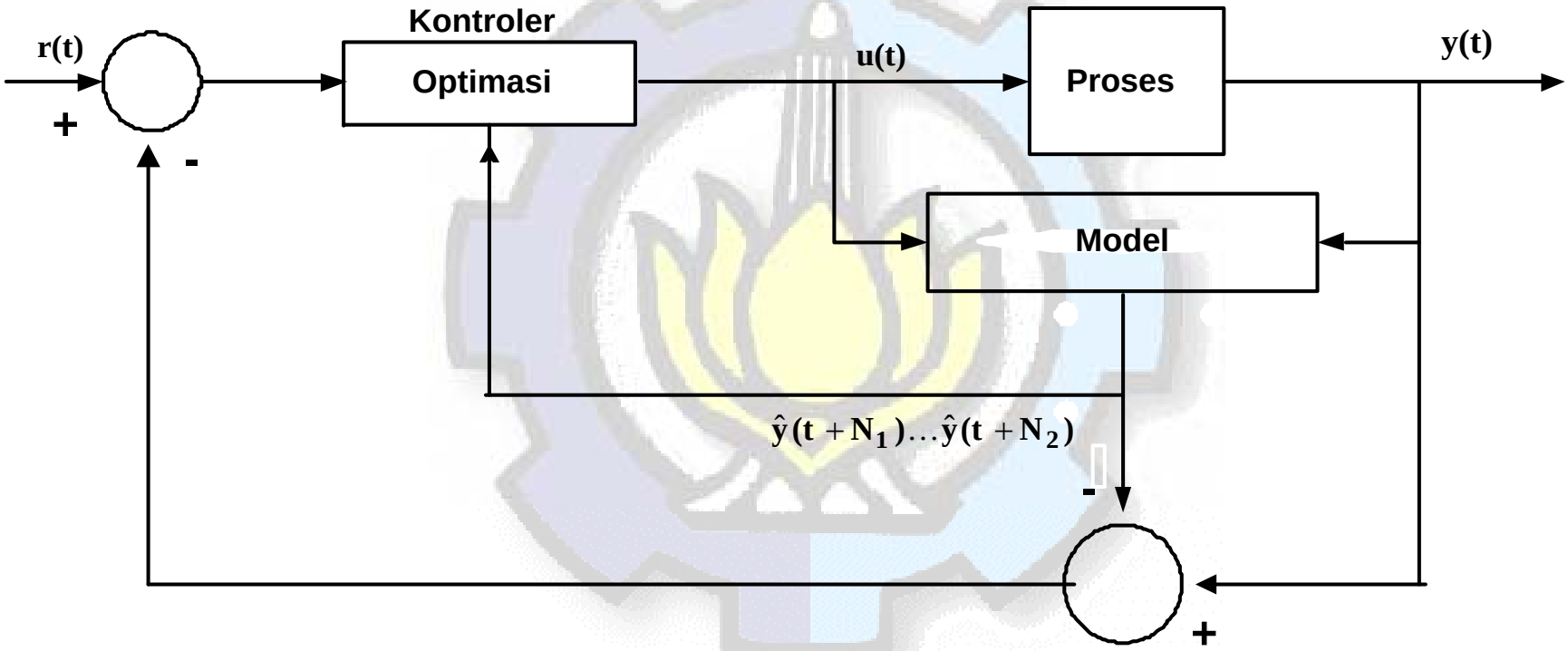
# Keuntungan Sistem Kontrol Prediktif

Predictive Control/Model Predictive Control is the only advanced control technique – that is, more advanced than standard PID control To have had a significant and widespread impact on industrial process control. The penetration of predictive control into industrial practice has also been helped by the facts that

- Its underlying idea is easy to understand
- Its basic formulation extends to multivariable plants with almost no modification.
- It is more powerful than PID control, even for single loops without constraints, even on difficult loops such as those containing long time delays.

*) Maciejowski, Predictive Control with Constraints, Prentice Hall 2002

# Diagram Blok Sistem Kontrol Prediktif



# Survey Sistem Kontrol Prediktif

- Zhu Y (1998), Multivariable process identification for MPC : the asymptotic method and its application, *Journal of Process Control*.
  - MPC technology has been widely and successfully applied in the refinery and petrochemical industry.
- Qin S.J, Badgwell T.A (2003), A Survey of Industrial Model Predictive Control Technology, *Control Engineering Practice*.
  - Terdapat lebih dari 2200 aplikasi sistem kontrol prediktif linier di industri dengan 70% penerapannya pada industri *refining* dan petrokimia
- Hussain M.A (1999), Review of the application of neural networks in chemical process control – simulatio and online implementation, *Artificial Intelligent in Engineering*
  - Terdapat banyak applikasi MPC pada proses kimia termasuk kolom distilasi, CSTR, dll
- Chandra PVS, Model Predictive Control of Ethyl Acetate Reactive Distillation Column **and** Engell S (2000), Neural networks for modelling and control of reactive distillation column
  - Aplikasi MPC pada kolom distilasi

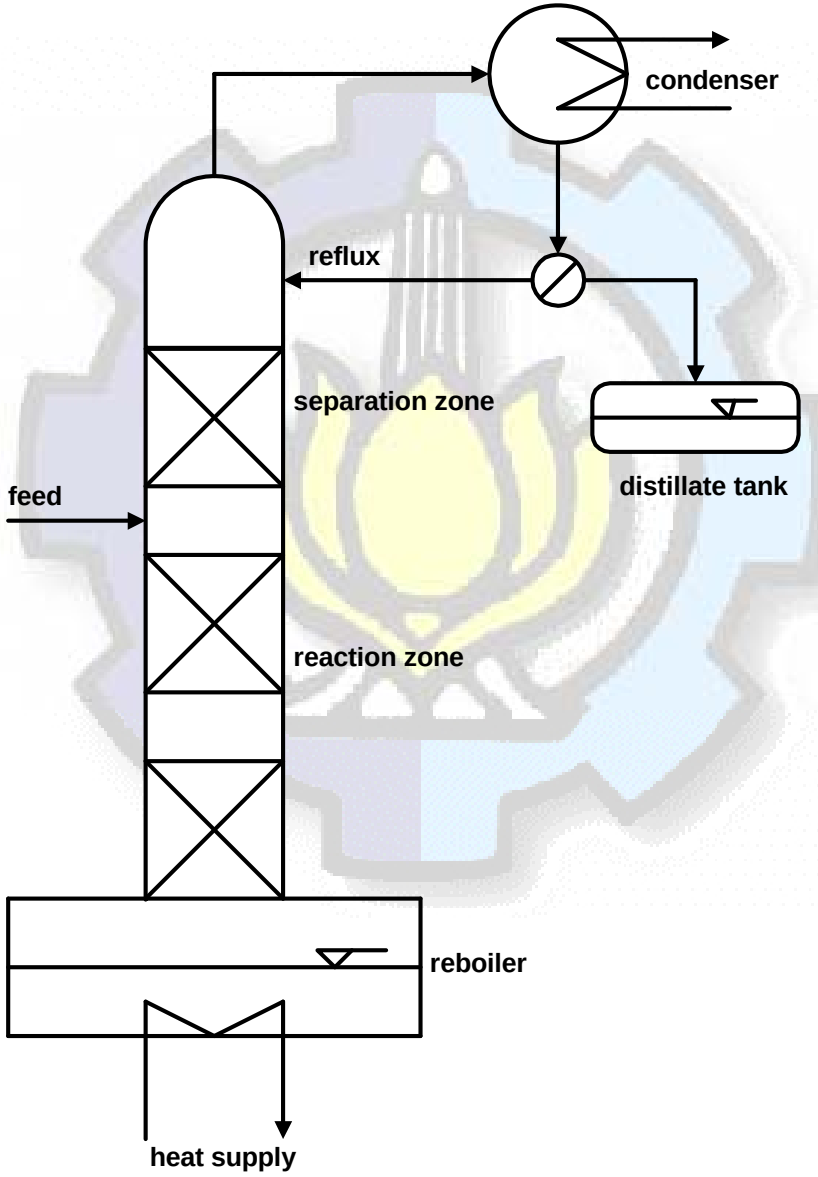
# Survey Kontrol Prediktif

- Zanin AC (2002), Integrating real time optimization into the model predictive controller of the FCC system, *Control Engineering Practice*
  - Algoritma optimasi pada MPC untuk FCC sistem
- Wang (2004), A new robust model predictive control method, *Journal of Process Control*
  - Algoritma baru pada MPC

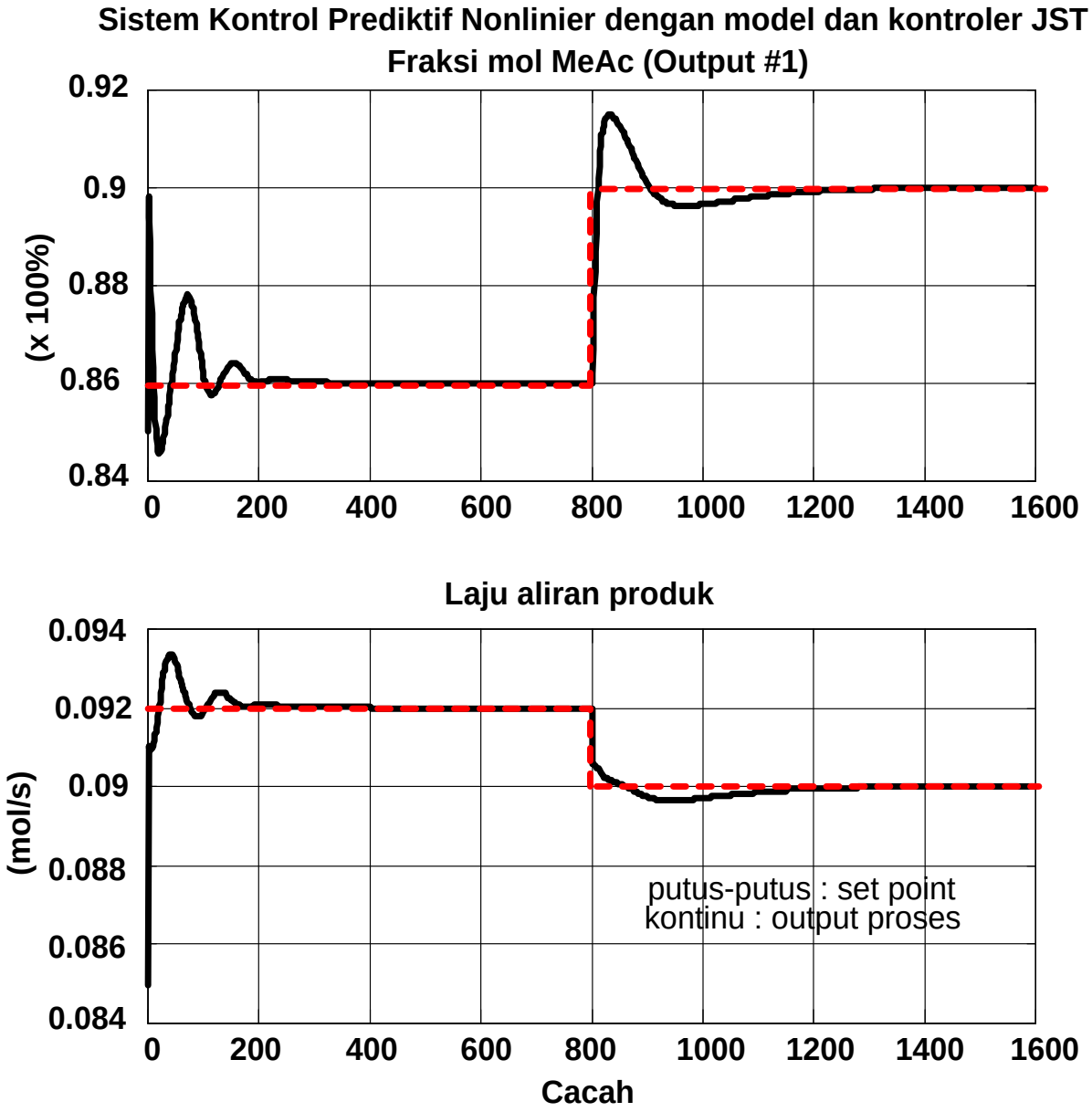
# Prediktif Kontrol di Teknik Fisika FTI – ITS (1)

- Short research di Department of Chemical Engineering, Univ. Dortmund Germany
- Sponsored by DAAD
- Design of Neural Networks Based Nonlinear Multivariable MPC on Reactive Distillation Column

# Prediktif Kontrol di Teknik Fisika FTI – ITS (2)



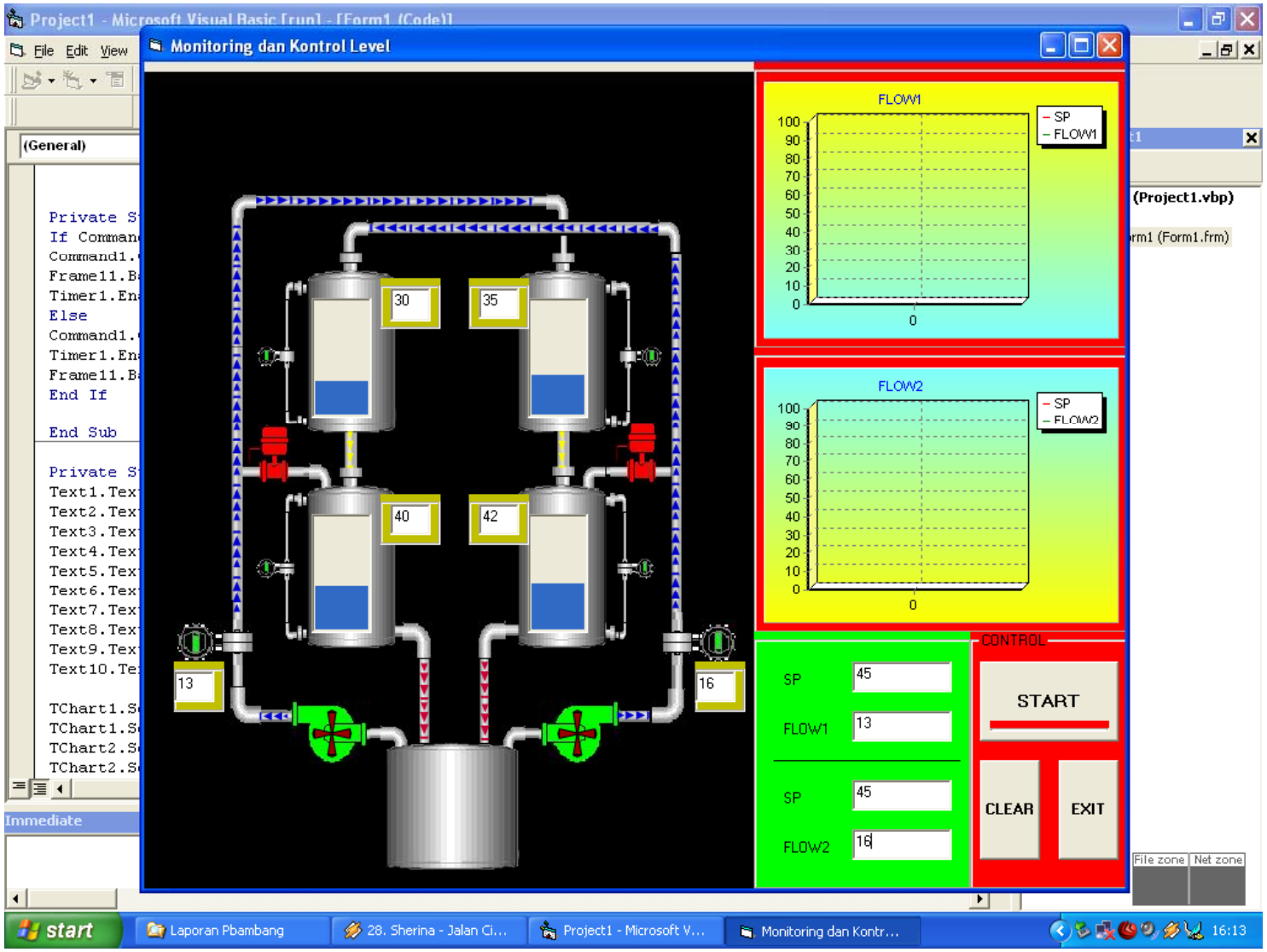
# Prediktif Kontrol di Teknik Fisika FTI – ITS (3)



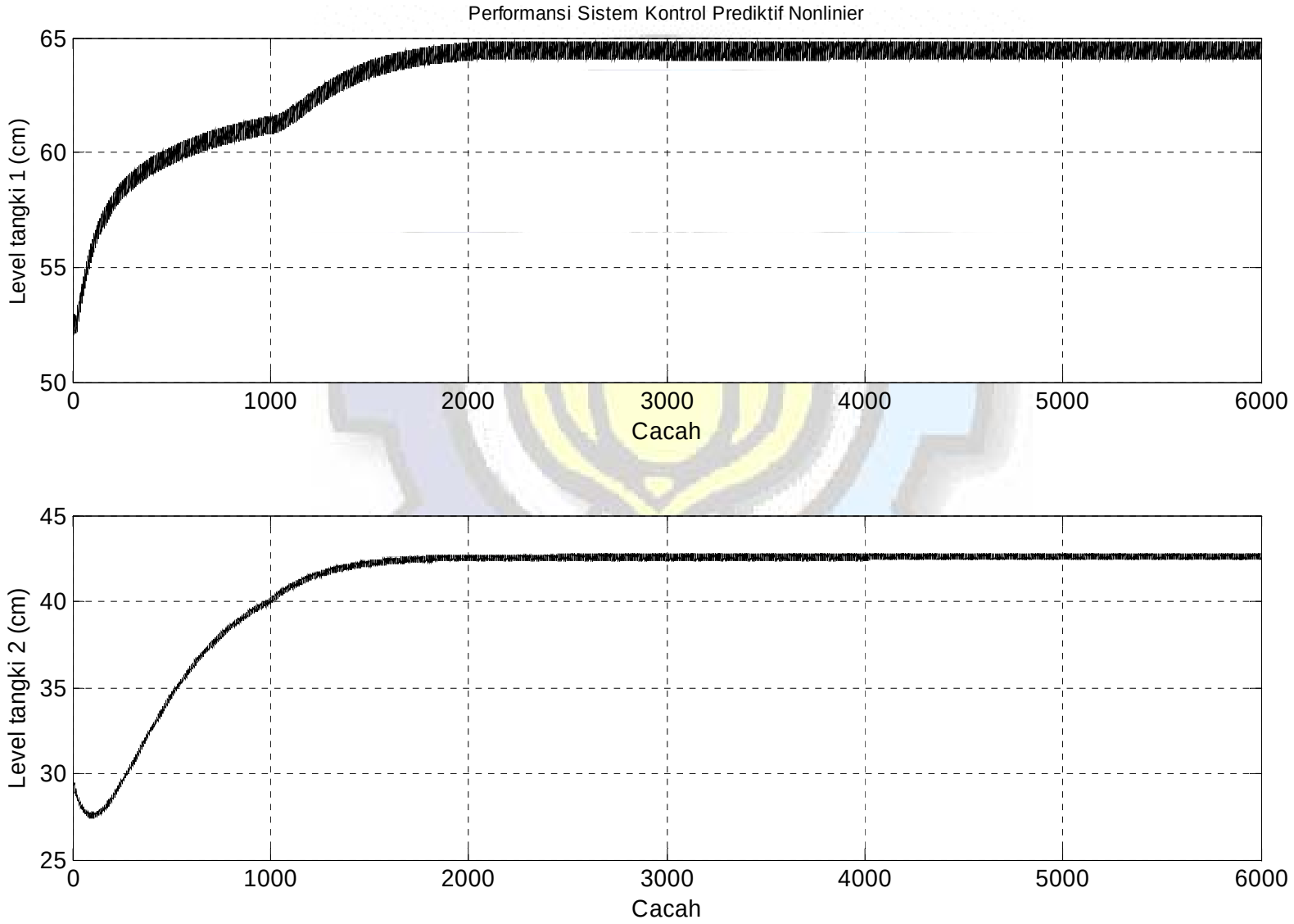
# Prediktif Kontrol di Teknik Fisika FTI – ITS (4)

- Pengembangan multivariabel MPC serta implementasi online
- Proses tangki bertingkat (quadruple tanks)
- Didanai Hibah Bersaing Ditjen Dikti Depdiknas

# Kontrol Prediktif di Teknik Fisika FTI – ITS (6)



# Kontrol Prediktif di Teknik Fisika FTI – ITS (7)



# Kesimpulan

Sistem kontrol prediktif memiliki beberapa keunggulan yang dapat dimanfaatkan sebagai salah satu alternatif sistem kontrol di industri migas.

Penelitian yang intensif memang perlu terus dilakukan dengan melibatkan banyak kalangan baik akademisi, industri, maupun produksen instrumen