

**TUNING OF PID CONTROLLER FOR COUPLED-TANK LIQUID LEVEL
CONTROL SYSTEM USING A STOCHASTIC SEARCH TECHNIQUE**

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ABSTRACT

A common control problem in process industries is the control of fluid and temperature in storage tank, chemical blending and reaction vessel. The situation requires fluid to be supplied to a chemical reactor at a constant rate. An upper tank can be used for filtering the variations in the upstream supply flow. Coupled tanks systems are favorite equipment in control engineering laboratories for research and educational purposes. Although the dynamics of the fluid level control systems are relatively straightforward, sometimes they involve challenging problems. In particular, for tanks where the cross section varies with the fluid level, the dynamics of the flow can change extensively with the operating conditions of the process due to the nonlinearity between level and fluid volume in the tank. In this project, Particle Swarm Optimization (PSO) is used to tuning Proportional-Integral-Derivative (PID) controller parameters for a model of coupled-tank liquid level. The task is to show that PSO tuning method is capable and have better performance in tuning PID parameter. For comparison purpose, conventional tuning method is introduced and analyzed. To measure the performance, performance indices had been used which are ITAE (Integral of Time Absolute Error), IAE (Integral of Absolute Error) and ISE (Integral of Squared of Error). The outcome from this project shows that PSO tuning method have the advantages in reducing the tuning time and can achieved response with satisfactory performance.

ABSTRAK

Satu masalah umum bagi sistem kawalan di dalam industri ialah kawalan bendalir and suhu di dalam tangki simpanan, tangki bancuhan dan tangki reaktor. Keadaan ini memerlukan bendalir disalurkan ke reaktor kimia pada kadar yang tetap. Tangki atasan boleh digunakan untuk menapis kepelbagaian bahan yang terdapat di dalam saluran. Sistem tangki berkembar adalah perlatan yang sesuai di dalam kejuruteraan kawalan untuk tujuan penyelidikan dan pembelajaran. Walaupun sifat dinamik bagi sistem kawalan bendalir adalah mudah, namun kadang-kala ia melibatkan masalah yang mencabar. Secara khusus, bagi tangki yang mempunyai keratan rentas yang berubah dengan ketinggian bendalir, sifat dinamik bagi bendalir boleh berubah dengan ketara di dalam keadaan operasi disebabkan oleh hubungan tidak linear di antara ketinggian dan isipadu dalam tangki. Di dalam projek ini, Particle Swarm Optimization (PSO) digunakan untuk menentukan pembolehubah Proportional-Integral-Derivative (PID) bagi model ketinggian cecair tangki berkembar. Tugas ini menunjukkan bahawa kaedah penentukur PSO mampu and mempunyai prestasi yang lebih baik di dalam menentukan pembolehubah PID. Bagi tujuan perbandingan, kaedah menentukan yang biasa diperkenalkan dan dianalisa. Bagi mengukur tahap prestasi, index prestasi telah digunakan iaitu ITAE (Integral of Time Absolute Error), IAE (Integral of Absolute Error) and ISE (Integral of Squared of Error). Hasil daripada projek ini menunjukkan bahawa kaedah menentukan PSO memiliki kelebihan untuk mengurangkan masa menentukan dan berjaya mencapai prestasi yang dikehendaki.

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