

**Analiza nieliniowa dynamiki autotermicznych struktur fluidyzacyjnych /  
Katarzyna Bizon. – Kraków, 2017**

Spis treści

<b>Nomenclature</b>	<b>7</b>
<b>1. Introduction</b>	<b>11</b>
1.1. Fluidized-bed autothermal structures	11
1.2. Mathematical modeling of catalytic fluidized-bed reactors	13
1.3. Aim and scope of the work	17
<b>2. Mathematical models of a fluidized-bed catalytic reactor</b>	<b>21</b>
2.1. Preliminary remarks and main assumptions of the models	21
2.2. Hydrodynamics of a fluidized bed	23
2.3. Interphase mass and heat transfer	26
2.4. Mathematical model of a catalytic fluidized-bed reactor with emulsion pseudohomogeneity	27
2.5. Models of a catalytic fluidized-bed reactor with emulsion heterogeneity	33
2.5.1. Remarks on the models	33
2.5.2. Heterogeneous emulsion model with distributed-parameter model of a catalyst pellet	34
2.5.3. Lumped-parameter models of a catalyst pellet	39
2.5.4. Criteria for internal and external diffusion	41
<b>3. Mathematical models of fluidized-bed autothermal structures</b>	<b>43</b>
3.1. Autothermal structure with partial recirculation of hot products	44
3.2. Autothermal structure with external heat exchanger	46
3.2.1. Steady-state model of an autothermal heat exchanger	46
3.2.2. Dynamic model of an autothermal heat exchanger	48
3.3. Autothermal structure with circulation of catalyst pellets	50
<b>4. Numerical methods for solving models of autothermal structures</b>	<b>57</b>
4.1. Determination of steady states	58
4.2. Determination of branching points	61
4.3. Approximation methods for dynamic simulations	63
4.3.1. Method of lines	63
4.3.2. Galerkin method with an empirical orthogonal basis	66
<b>5. Comparison of the pseudohomogeneous emulsion model with the heterogeneous emulsion models</b>	<b>71</b>
5.1. Comparison of steady-state characteristics	71

5.2. Influence of the type of mathematical model on the results of dynamic simulations	79
5.3. Assessment of the approximation method accuracy	84
<b>6. Steady-state and dynamic analysis of fluidized-bed autothermal structures with single fluidized bed</b>	<b>91</b>
6.1. Fluidized-bed reactor without external thermal feedback	93
6.2. Configurations with external autothermal feedback	104
6.2.1. Influence of autothermal feedback onto steady-state and dynamic characteristics	104
6.2.2. Start-up of autothermal fluidized-bed reactors	113
6.3. Verification of the hypothesis about quasi-steady state operation of external autothermal heat exchanger	119
<b>7. Steady-state and dynamic analysis of fluidized-bed autothermal structures with circulation of catalyst pellets</b>	<b>121</b>
7.1. Steady-state and dynamic characteristics	122
7.2. Influence of external disturbances on the dynamics of autothermal structure	128
<b>8. Case study: oxidation of naphthalene to phthalic anhydride</b>	<b>133</b>
8.1. Reaction kinetics and process conditions	134
8.2. Results and discussion	136
<b>9. Summary and conclusions</b>	<b>145</b>
<b>References</b>	<b>151</b>
<b>Abstract</b>	<b>157</b>
<b>Riassunto</b>	<b>158</b>
<b>Streszczenie</b>	<b>160</b>