Research Group :

Optimal Technologies for Instrumentation-Sensor-Circuit-Control System Design (*Optimal Design*)

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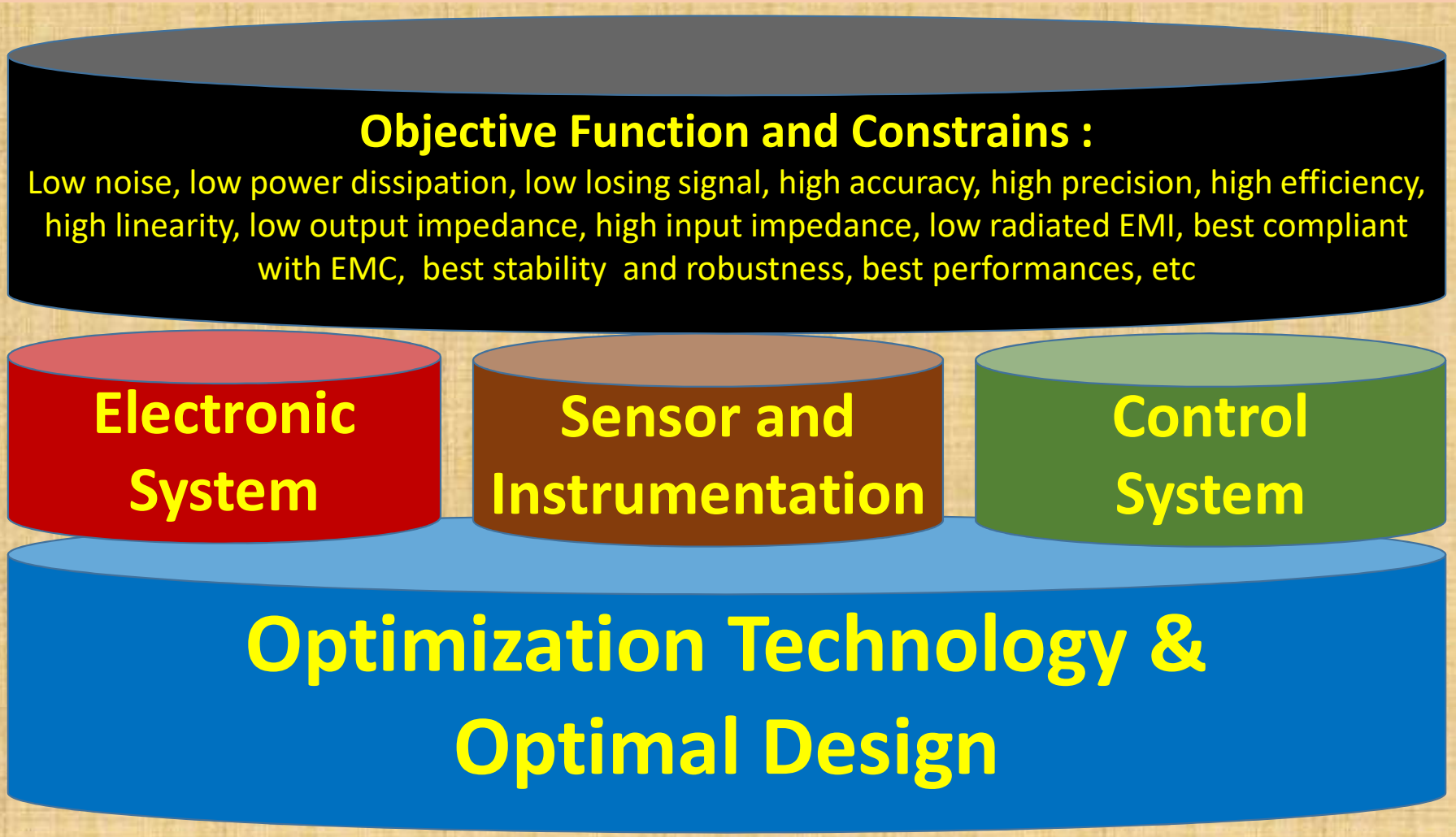
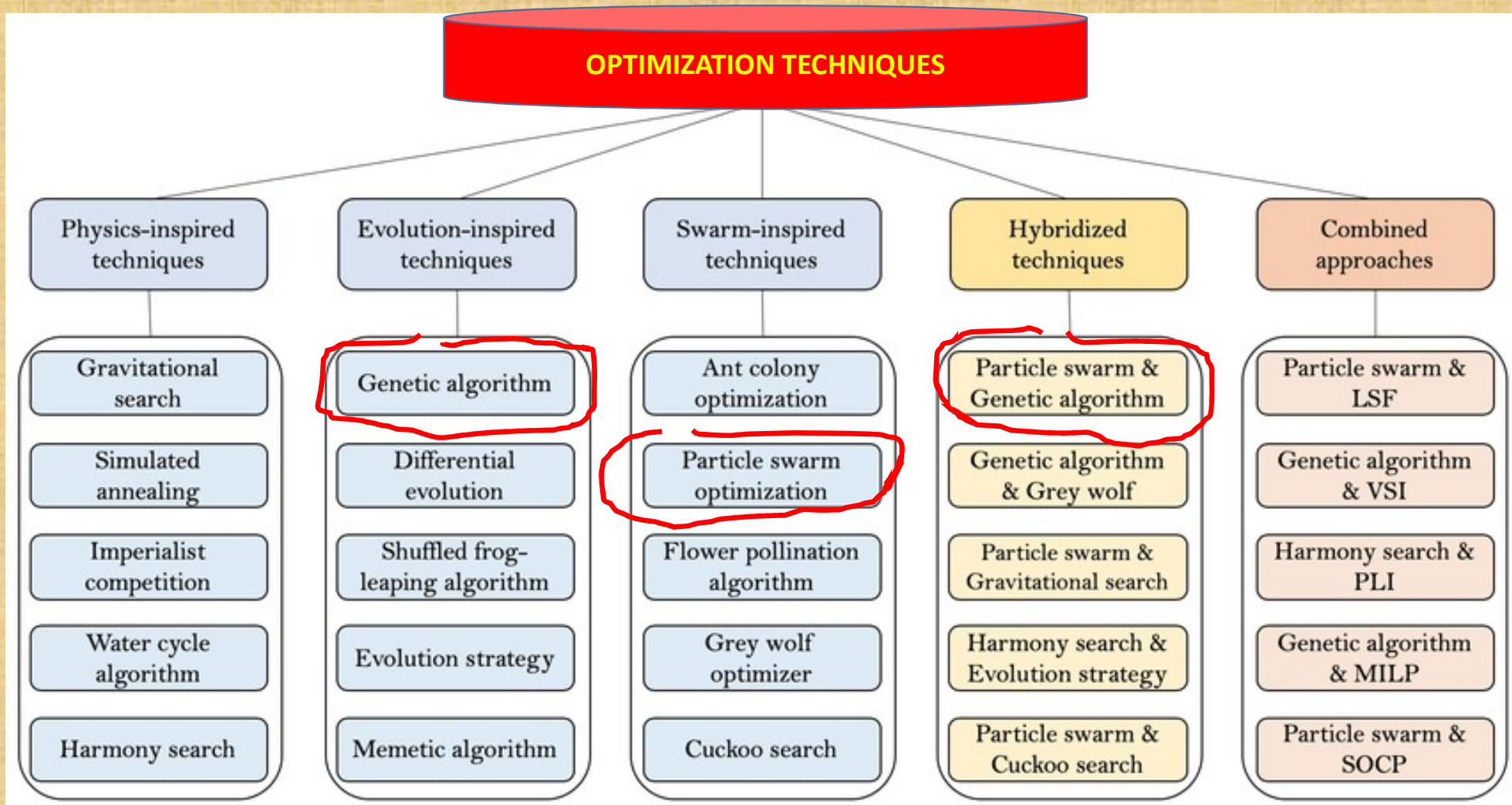
Deskripsi

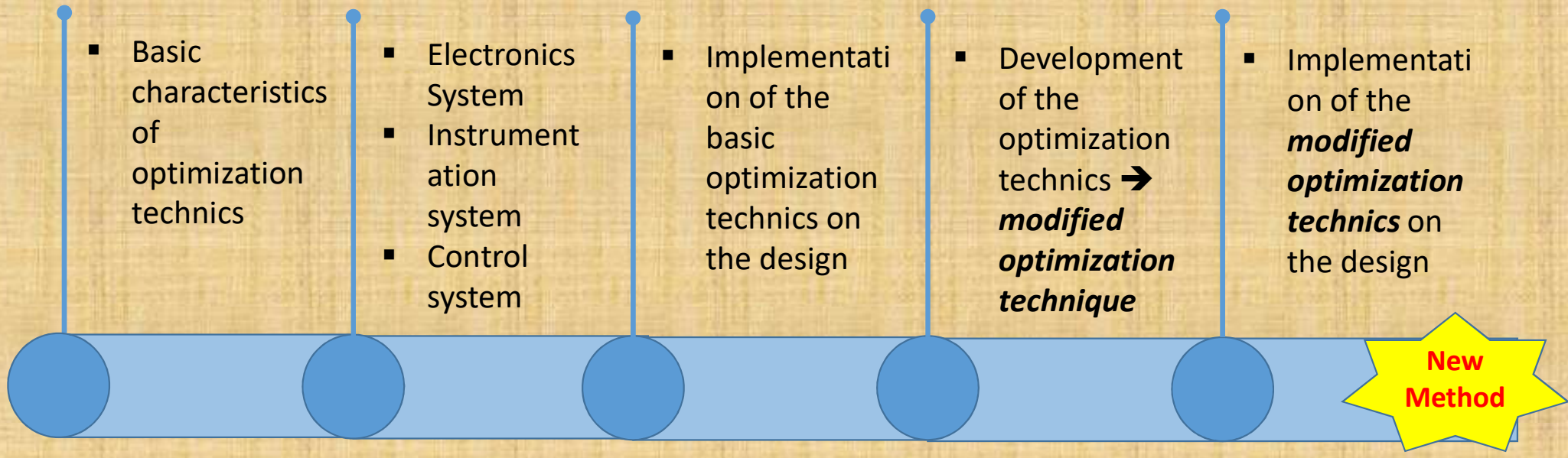

Objective Function and Constrains :
Low noise, low power dissipation, low losing signal, high accuracy, high precision, high efficiency, high linearity, low output impedance, high input impedance, low radiated EMI, best compliant with EMC, best stability and robustness, best performances, etc
Electronic System
Sensor and Instrumentation
Control System
Optimization Technology & Optimal Design


OPTIMIZATION TECHNIQUES
Physics-inspired techniques
Evolution-inspired techniques
Swarm-inspired techniques
Hybridized techniques
Combined approaches
Gravitational search
Simulated annealing
Imperialist competition
Water cycle algorithm
Harmony search
Genetic algorithm
Differential evolution
Shuffled frog-leaping algorithm
Evolution strategy
Memetic algorithm
Ant colony optimization
Particle swarm optimization
Flower pollination algorithm
Grey wolf optimizer
Cuckoo search
Particle swarm & Genetic algorithm
Genetic algorithm & Grey wolf
Particle swarm & Gravitational search
Harmony search & Evolution strategy
Particle swarm & Cuckoo search
Particle swarm & LSF
Genetic algorithm & VSI
Harmony search & PLI
Genetic algorithm & MILP
Particle swarm & SOCP

Deskripsi

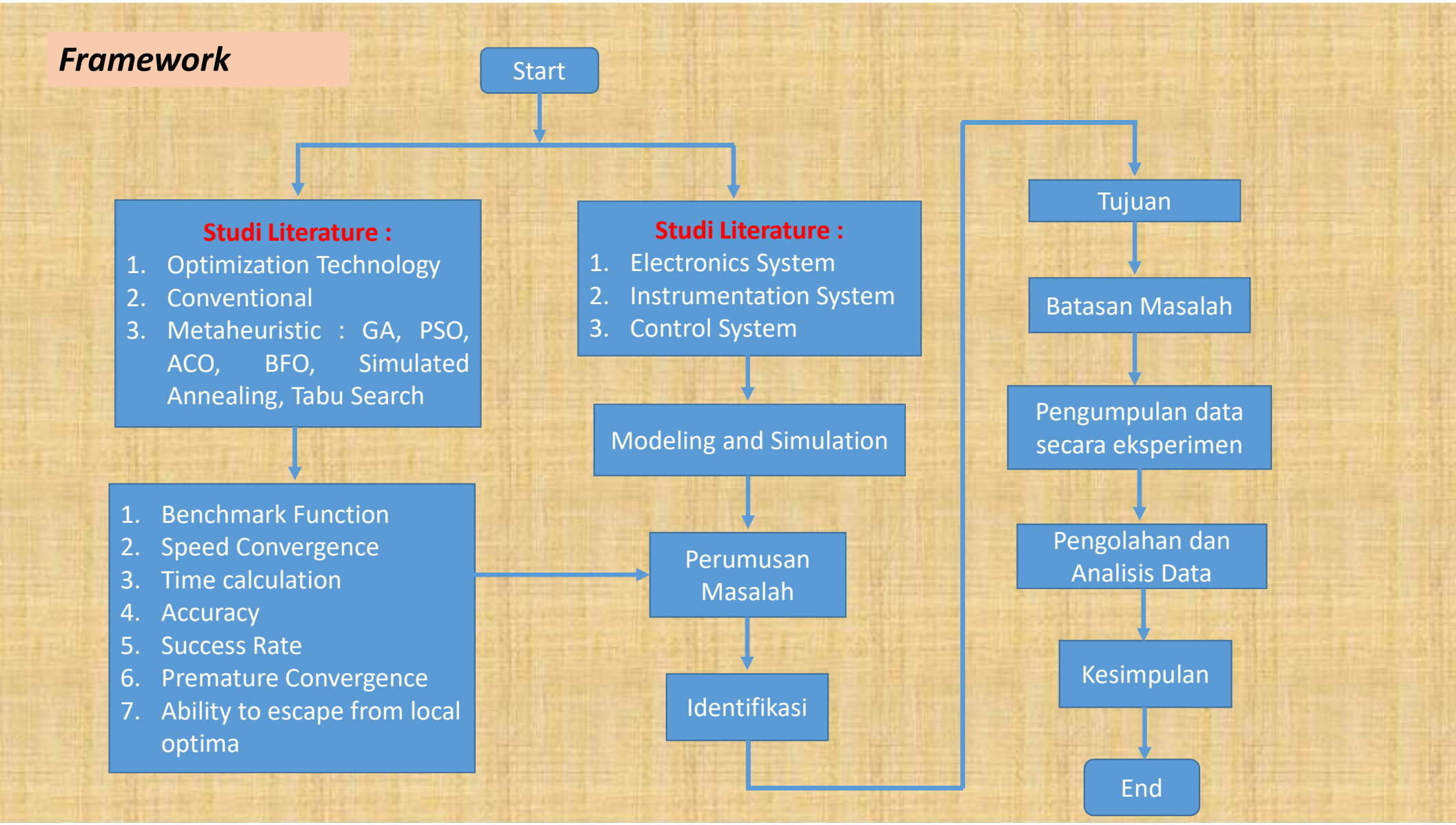
Research Group Optimal Technologies for Instrumentation-Sensor-Circuit-Control System Design adalah RG yang memfokuskan ***pengembangan dan aplikasi teknologi optimasi*** pada perancangan ***sistem rangkaian elektronika – sensor dan actuator – instrumentasi dan kontrol***. Dalam perancangan sistem elektronika, ada ***fungsi tujuan*** yang ingin dicapai untuk diminimalkan atau dimaksimalkan (misalnya *daya disipasi, losing signal, noise, output impedance, radiated EMI, efisiensi, input impedance, frequency bandwidth, stability, robustness, performances*). Umumnya fungsi tujuan yang ingin dicapai dipengaruhi oleh ***constrain*** atau ***fungsi-fungsi pembatas*** yang akan mempersulit tercapainya tujuan perancangan. Oleh karena itu teknologi optimasi diperlukan dalam perancangan sistem agar target tercapai dan mendapatkan performansi sebaik-baiknya. RG ini akan mengembangkan ***teknologi optimasi*** dan ***optimal design*** pada sistem elektronika - sensor dan actuator - instrumentasi dan kontrol, baik yang konvensional maupun yang berbasis artificial intelligence (AI) atau metaheuristic.

Roadmap



- 2022
  - Basic characteristics of optimization technics
  - GA, PSO, ACO, BFO, GWO
- 2023
  - Electronics System
  - Instrumentation system
  - Control system
  - Multistage amplifier
  - Higher order filter
  - Sensor linearization
  - Converter & inverter
  - PID controller
- 2024
  - Implementation of the basic optimization technics on the design
  - Comparison to the conventional methods
- 2025
  - Development of the optimization technics ➔ ***modified optimization technique***
  - Comparison to the standard optimization technique
- 2026
  - Implementation of the ***modified optimization technics*** on the design
  - Comparison to the standard optimization technique on system

Framework


Start
Studi Literature :
1. Optimization Technology
2. Conventional
3. Metaheuristic : GA, PSO, ACO, BFO, Simulated Annealing, Tabu Search
1. Benchmark Function
2. Speed Convergence
3. Time calculation
4. Accuracy
5. Success Rate
6. Premature Convergence
7. Ability to escape from local optima
Studi Literature :
1. Electronics System
2. Instrumentation System
3. Control System
Modeling and Simulation
Perumusan Masalah
Identifikasi
Tujuan
Batasan Masalah
Pengumpulan data secara eksperimen
Pengolahan dan Analisis Data
Kesimpulan
End

Target Capaian dalam 5 tahun

Tahun	Judul	Publikasi dan HAKI
2023	1. Low Power Multistage Amplifier Design using Particle Swarm Optimization 2. Novel Particle Swarm Optimization for Low Pass FIR Filter Design 3. Ant Colony Optimization for the Optimal Design of Analog Filters	S1 / S2 / HAKI / Prototype
2024	1. Linearization of Thermistor Sensor using Grey Wolf Optimization 2. Optimal Design of PID Controller using Bacterial Foraging Optimization for Buck Converter 3. Parameter Identification of the System using Genetic Algorithm	S1 / S2 / HAKI / Prototype
2025	1. Comparison of Modified PSO and Standard PSO 2. Comparison of Simplified GA and Standard GA 3. Comparison of PSO and GA	S1 / S2 / HAKI
2026	1. Low Power Multistage Amplifier Design using Modified Particle Swarm Optimization 2. Novel Particle Swarm Optimization for Low Pass FIR Filter Design 3. Simplified Genetic Algorithm for the Optimal Design of Analog Filters	S1 / S2 / HAKI / Prototype
2027	1. Optimal Design of PID Controller using Modified Bacterial Foraging Optimization for Buck Converter 2. pH neutralization Process Control using Modified Ant Colony Optimization 3. Thermal Process Control using Modified Grey Wolf Optimization	S1 / S2 / HAKI / Prototype

有難うございます＝Terima kasih