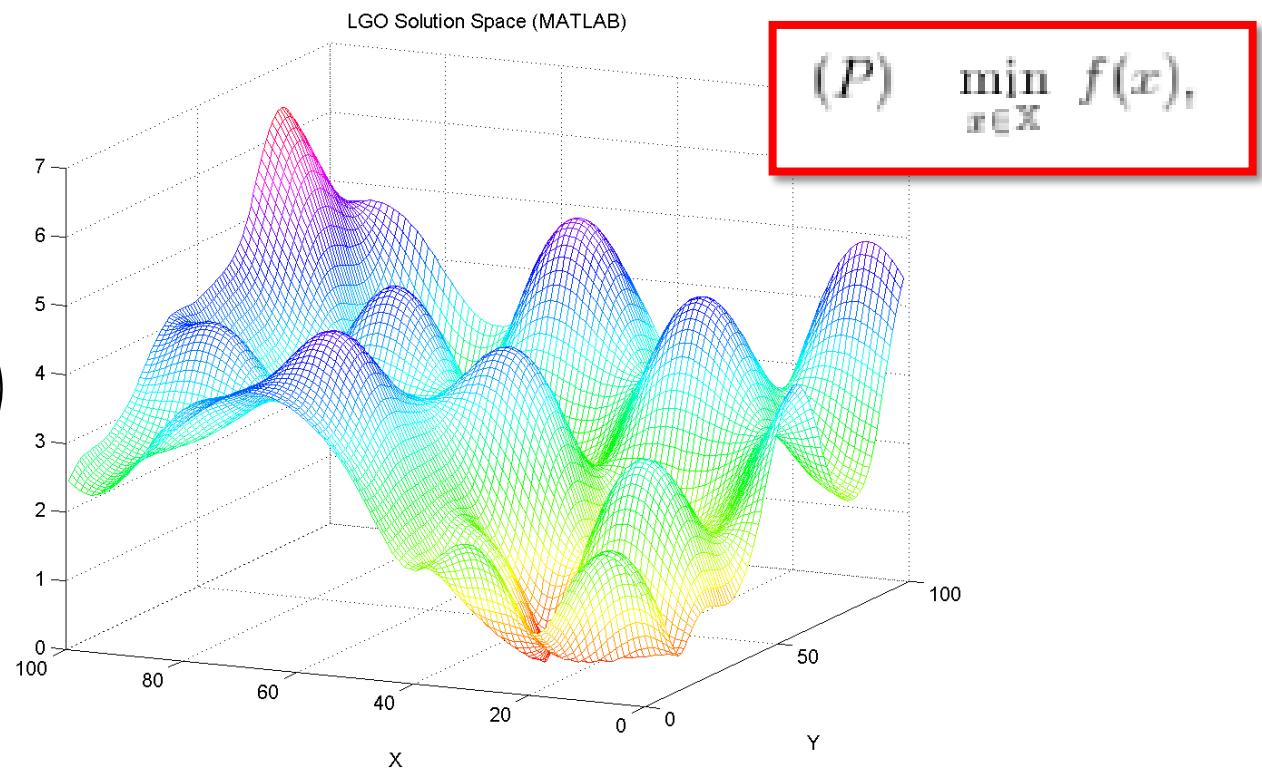


Global Optimization

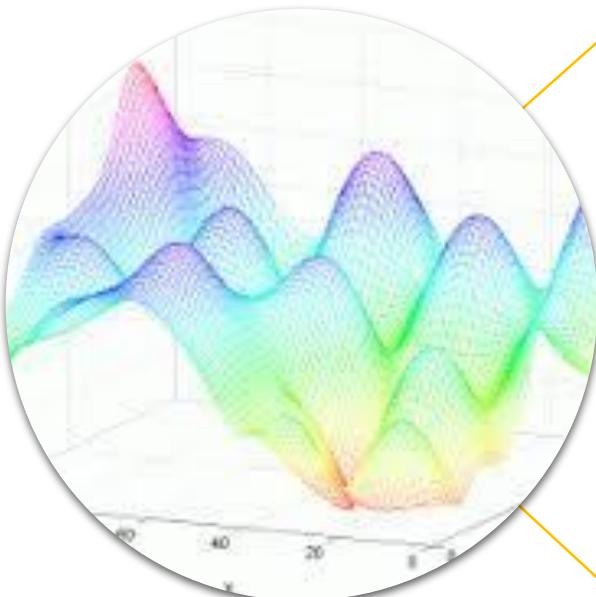
Global Optimization Problems

- Optimasi Global ditujukan untuk mencari solusi terbaik dari **permasalahan optimasi berkendala** yang memiliki nilai **local optima bervariasi**.

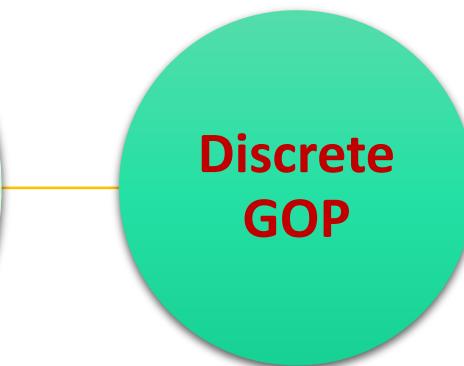
"No single optimization package can solve all global optimization problems efficiently."



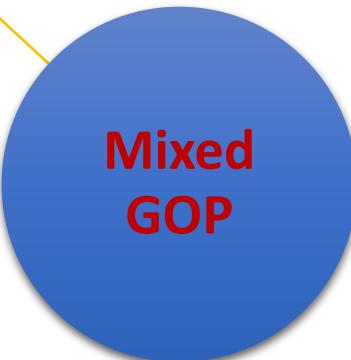
Classification



- Real



- Integer



- Real + integer

Continuous Global Optimization Problems

Stochastic/heuristic Approach

Multi-start algorithm

- Algoritma ini menghasilkan banyak poin dari distribusi probabilitas tertentu atas *feasible region* menggunakan beberapa metode *local search* dari beberapa titik yang mendekati nilai optimal

Simulated annealing algorithm

- Generalisasi metode montecarlo yang berasal dari analogy proses Annealing

Evolutionary/genetic algorithm

- Mensimulasikan evolusi biologis spesies unggul semakin tinggi kelangsungan hidupnya

Continuous Global Optimization Problems

Deterministic Approach

Branch & Bound

- Membagi daerah feasible menjadi beberapa bagian dan membuang bagian yang tidak menjanjikan serta mengikat fungsi tujuan dari bagian tersebut menggunakan batas bawah

Function modification

- Metode yang menggunakan modifikasi fungsi tujuan yang tepat dengan fase *initialization, local search* dan *global search*

Discrete Global Optimization Problems

Stochastic/heuristic Approach

Multi-start algorithm

Simulated annealing algorithm

Evolutionary/genetic algorithm

Tabu search algorithm

Discrete Global Optimization Problems

Deterministic Approach

Branch & Bound

Dynamic programming

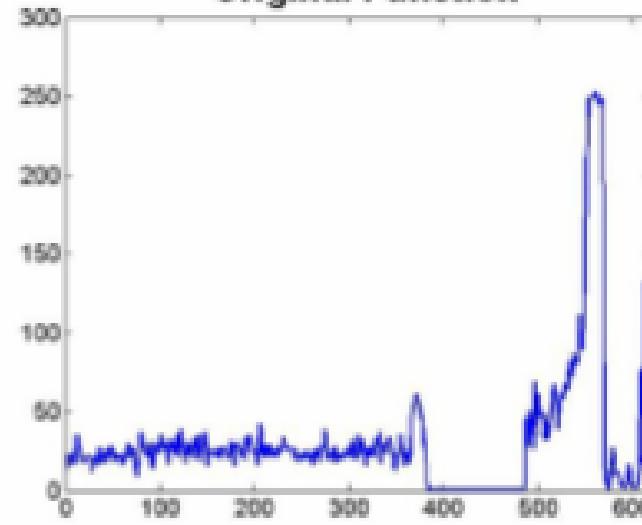
Function modification

Lagrangian

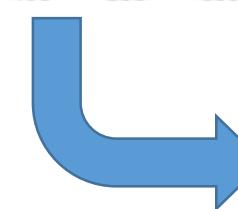
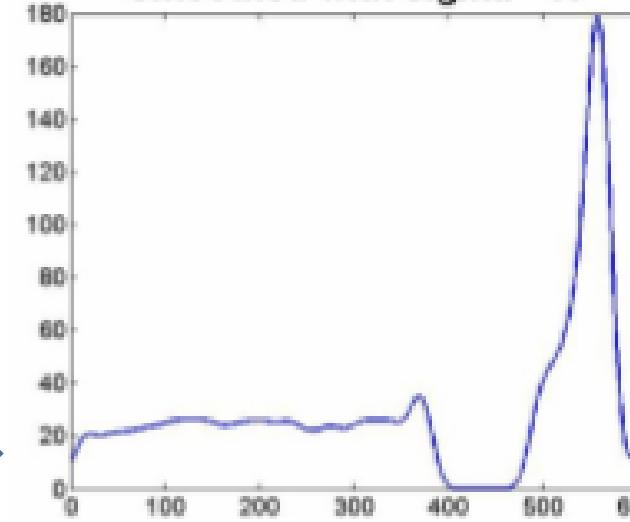
Etc..

Smoothing optimization problem

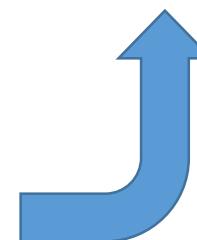
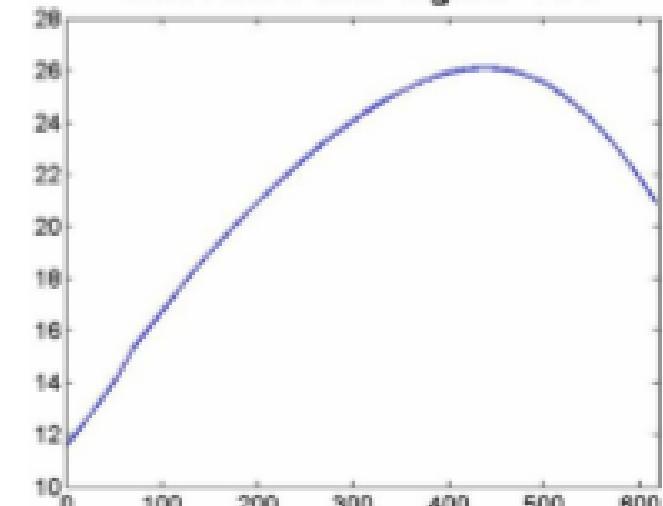
Original Function



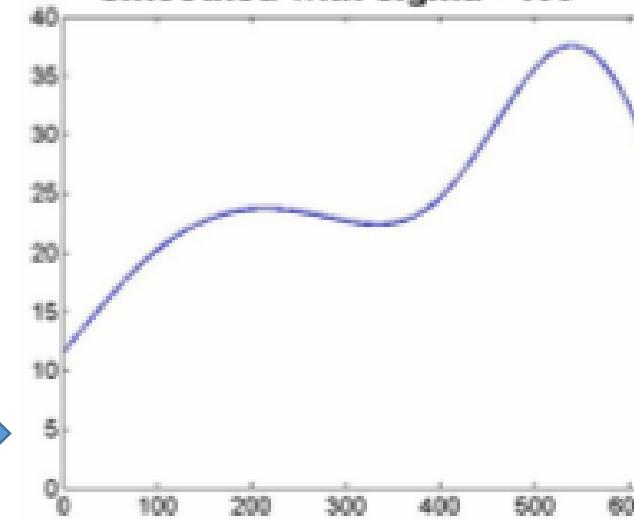
Smoothed with sigma = 10



Smoothed with sigma = 200



Smoothed with sigma = 100



Smoothing optimization problem

Examples of functions that do not have continuous first partials everywhere are

1. $|f(x)|$
2. $\max(f(x), g(x))$
3. $h(x) = \{ \text{if } x_1 \leq 0 \text{ then } f(x) \text{ else } g(x) \}$
4. A piecewise linear function interpolating a given set of (y_i, x_i) values.



reformulate them as equivalent smooth functions by introducing additional constraints and variables.

Example:

- Weighted absolute error between the measured and model output

$$\text{Minimize: } e(\mathbf{x}) = \sum_{i=1}^n w_i |y_i - h(v_i, \mathbf{x})|$$

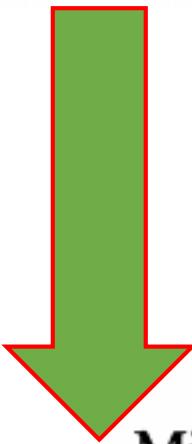
where \mathbf{x} = a vector of model parameter values

w_i = a positive weight for the error at the i th data point

y_i = the measured output of the system being modeled when the vector of system inputs is v_i

$h(v_i, \mathbf{x})$ = the calculated model output when the system inputs are v_i

$$\text{Minimize: } e(\mathbf{x}) = \sum_{i=1}^n w_i |y_i - h(v_i, \mathbf{x})|$$



Eliminating the nonsmooth
absolute value function by
introducing positive and negative
deviation

$$\text{Minimize: } \sum_{i=1}^n w_i (dp_i + dn_i) \quad (10.1)$$

$$\text{Subject to: } y_i - h(v_i, \mathbf{x}) = dp_i - dn_i \quad i = 1, \dots, n \quad (10.2)$$

$$\text{and } dp_i \geq 0, \quad dn_i \geq 0 \quad i = 1, \dots, n \quad (10.3)$$

error (+), dpi (+), dni = 0

Error (-), dpi = 0, dni (+)



**OPTIMAL
SOLUTION**

