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NUMERICAL METHODS & OPTIMISATION

Curve Fitting Tutorial

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Chapter Description

- Aims
  - Apply numerical methods in solving engineering problem and optimisation
- Expected Outcomes
  - Apply the curve fitting methods to solve engineering problems
- References
  - Steven C. Chapra and Raymond P. Canale (2009), Numerical Methods for Engineers, McGraw-Hill, 6th Edition

Application in engineering problem: Class activity

Intravenous infusions usually are driven by gravity hanging the fluid bottle to counteract the blood pressure in the vein and to force the fluid into the body. The gauge pressure of the blood in the patient's vein is $1.066 \times 10^3 N/m^2$ for sufficient flow. The saline solution in the fluid bottle is injected through a needle of suitable radius and length at rate of 0.120 cm^3 /s. Assuming laminar flow, Poseuille's law applies. This is given by:

$$Q = \frac{(P_2 - P_1)\pi r^4}{8\eta l}$$

where P_2 is the pressure at the entrance of the needle and P_1 is the pressure in the vein. The only known is P_2. Determine the most suitable radius of the needle if the pressure at the entrance of the needle is 2.0000×10^3 N/m^2 for sufficient flow which given that the lengths of the needle are 0.025m and 0.040m. Use interpolation method to solve this problem

Application in engineering problem: Class activity

A pharmaceutical engineer in a factory manufacturing a drug name PRIMIDONE. He wants to test whether their Active Pharmaceutical Ingredients is at a range of less than 5% error by comparing with normal desired dose which is **250mg.** This uniformity test must be performed in order to determine the safety of drug by having consistent content of drugs when it is consumed since this drug is in category D drug. He has chosen a method of weight variation in order to test their uniformity. Knowing that an individual weight of less than desired normal weight will contribute in decreasing in therapeutic effect while and vice versa. By using an appropriate method for curve fitting, calculate the content error of each samples in 20 tablets by comparing with the desired dose of *Primidone*

Application in engineering problem: Class activity (cont'd)

	Tablets (mg)	X $(x10^{-3})$	Deviation (%)
1.	245.75	4.25	1.7
2.	246.25	3.75	1.5
3.	252.50	2.50	-1.0
4.	243.79	6.21	2.5
5.	243.25	6.75	2.7
6.	247.54	2.46	1.0
7.	244.36	5.64	2.3
8.	240.93	9.07	3.6
9.	246.04	3.96	1.6
10.	242.82	7.18	2.9

Application in engineering problem: Class activity (cont'd)

	Tablets (mg)	X(x10^{-3})	Deviation (%)
11.	246.14	3.86	1.5
12.	238.79	11.21	4.5
13.	251.43	1.43	-0.6
14.	241.89	8.11	3.2
15.	245.64	4.36	1.7
16.	240.18	9.82	3.9
17.	251.64	1.64	-0.7
18.	239.86	10.14	4.1
19.	245.54	4.46	1.8
20.	240.71	9.29	3.7

Curve Fitting: Tutorial
By Raihana Edros
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Conclusion

- First and higher-order of mathematical model that represents the experimental data can be estimated by using different kinds of curve fitting methods
- Regression coefficient, standard deviation and standard error of experimental data can be estimated by using different kinds of curve fitting methods

Main Reference

Steven C. Chapra and Raymond P. Canale (2009), Numerical Methods for Engineers, McGraw-Hill, 6th Edition

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