Global Journal of Engineering Design & Technology

Extended Abstract

Lagrange Multiplier Method for Drilling Oil Reservoir

Vasant P

Introduction

Practical Use of the Concept in Petroleum Engineering

Casing is one of the basic process in drilling the petroleum out of the reservoir. Steel is widely used in casing because of its durability and corrosion resistance. Since the petroleum business is at peak nowadays, one can observed many oil rigs on shore and o ۏshore throughout the world. Many theories are being used in petroleum exploration, extraction and production. One of them is Lagrange Multiplier method. In mathematical optimization, the method of Lagrange multipliers (named Dier Joseph Louis Lagrange (2, 3)) is a strategy for finding the local maxima and minima of an objective function subject to equality constraints. Lagrange multiplier is used when some constraints are faced in the working process. An example of the use of Lagrange Multiplier in casing instalment in an oil rig. He use of the theory is presented from the economic aspect of view. In this problem, a steel casing is to be installed. Let's say the labour cost for the instalment is 20$ per hour. He price of the steel is 2000$ per ton. He manager of the project is provided with the budget of 20,000$ and the cost of the whole project has to be sDtisfied with the provided budget. Now this problem is dealing with the constraint. In this case, Lagrange Multiplier is found to be very useful. Let the hours of labour and tons of steel be "h" and "s" respectively. He objective function is given in eqn. (1). (1) He cost of labour and the tons of steel have to fall within the provided budget. So the cost of labour become 20h and the cost of steel required become 2000s. So the constraint function is given in eqn.

By the using the Lagrange multiplier, one have to partially di ۏerentiDte both equations with respect to h and s. Since only one constraint is given here, therefore only one parameter 'λ' has to be considered as in eqn. (3). h=200 s (3) Substituting h=200s in constraint eqn. (2), the value of 's' can be determined, which is "s=10/3 tons " (tons of steels required). Substitute s=10/3 into h=200 s, this gives h=2000/3 hours. So the manager finDOO\ figure out how to make it happen with the provided budget in the decision making process. His is the use of the concept of Lagrange Multiplier in Petroleum Engineering business in economic point of view.

Next, there is another problem concerning with the Petroleum Geoscience. Let's say the function of the temperature of the central earth core is calculated as follow; the earth is considered as a sphere so one can use the sphere equation

In this case, Lagrange Multiplier is found to be very useful. Let the hours of labour and tons of steel be "h" and "s" respectively. He objective function is given in eqn. (1). (1) He cost of labour and the tons of steel have to fall within the provided budget. So the cost of labour become 20h and the cost of steel required become 2000s. So the constraint function is given in eqn. (2). G (h,s)=20 h + 2000 s=20,000 (2) y, and z in the main objective function as in eqn. (4), the desired temperature can be obtained as 890625°F. He use of the Lagrange multiplier is important in every engineering fieOd, in daily lives, in economics and it is so important that it still hold a position.

He problem is to find the maximum temperature along the diameter. By the nature of the problem, there are two constraints and so there are two parameters, 'λ' and 'μ' to be considered in this case. One can start by partially di ۏerentiDting the three eqns. (4)-(6). By satisfying those equations, one can find the value for the λ=-500 and μ=13000/6. Substituting those two in the above equations will give the values of x=833.333, y=291.67, and z=333.33. Substituting these x,

He objective function is given in equation F(x,y,z)=x2+ y2+ z2 (4) Since the earth is a bit flDt on the North Pole, therefore there are two constraints, one from North Pole and the other from South Pole. So the diameters of the central core is given in eqns. (5) and (6). G(x,y,z)=x + 2y + 3z=3000 miles (5) H(x,y,z)=x + y + z=4000 miles (6) He problem is to find the maximum temperature along the diameter. By the nature of the problem, there are two constraints and so there are two parameters, 'λ' and 'μ' to be considered in this case. One can start by partially di ۏerentiDting the three eqns. (4)-(6). By satisfying those equations, one can find the value for the λ=-500 and μ=13000/6. Substituting those two in the above equations will give the values of x=833.333, y=291.67, and z=333.33. Substituting these x,

Pandian Vasant
Teknologi PETRONAS, Malaysia,pvasant@gmail.com

References

1. https://www.khanacademy.org/

2. Anton H, Bivens I, Davis S (2010) Calculus Early Transcendental 9th edition. John Wiley & Sons Inc USA.

3. Johnston EH, Mathews JC (2002) Calculus. Addison and Wesley, USA.

Pandian Vasant
Teknologi PETRONAS, Malaysia,pvasant@gmail.com