BIM A+

European Master in
Building Information Modelling

Programming assignments - 03

Topic 2: Fundamentals of programming

BIM A+3: Parametric Modelling in BIM

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Create a simple application

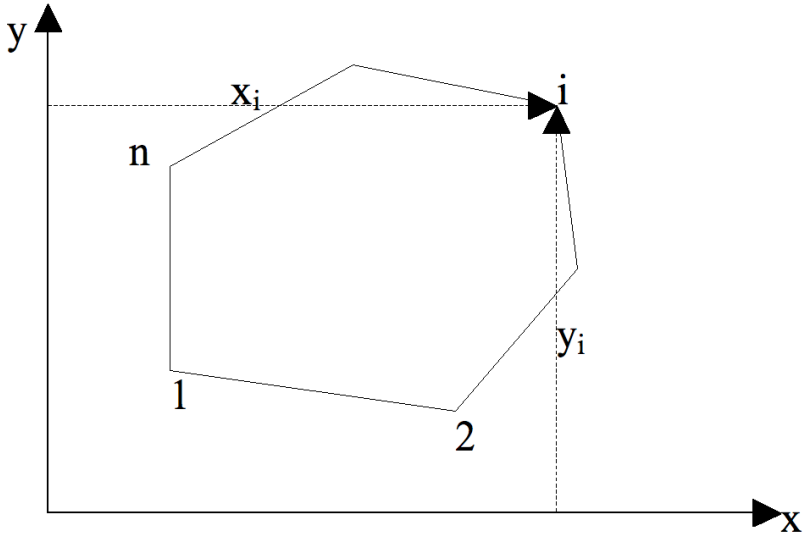
- Develop a simple application for calculating different geometrical characteristics of a polygon shape using Python programming language.
- Basic requirements:
  - The end-user must be able to calculate polygon shapes of different sizes - the number of polygon points must not be limited.
  - The program should display end-user entered data (x and y coordinates of polygon points) in a “table” format.
  - The calculated results must be displayed with two decimal numbers.
- Work submission:
  - Deadline: 2. 12. 2022
  - Upload your solution to your GitHub repository and share the repository link (https://docs.google.com/spreadsheets/d/1hH-0Dsa9buz2bGSMVgMQcfZF_sWg3dcOWialk5apCkQ/edit?usp=sharing)

- *Instructions:*
  - *Start with VERY basic solution and work from there :-)*
  - *The formulas are on the next slide.*
  - *The points must be ordered counter clockwise.*

Formulas

Površina prečnega prereza:

$$A_x = \frac{1}{2}\sum_{i=1}^{n}\left(x_{i+1}+x_i\right)\left(y_{i+1}-y_i\right)$$



Statična momenta prečnega prereza:

$$S_x = -\frac{1}{6}\sum_{i=1}^{n}\left(x_{i+1}-x_i\right)\left(y_{i+1}^2+y_i\,y_{i+1}+y_i^2\right)$$

$$S_y = \frac{1}{6}\sum_{i=1}^{n}\left(y_{i+1}-y_i\right)\left(x_{i+1}^2+x_i\,x_{i+1}+x_i^2\right)$$

Osni vztrajnostni momenti prečnega prereza:

$$I_x = -\frac{1}{12}\sum_{i=1}^{n}\left(x_{i+1}-x_i\right)\left(y_{i+1}^3+y_{i+1}^2\,y_i+y_{i+1}y_i^2+y_i^3\right)$$

$$I_y = \frac{1}{12}\sum_{i=1}^{n}\left(y_{i+1}-y_i\right)\left(x_{i+1}^3+x_{i+1}^2\,x_i+x_{i+1}\,x_i^2+x_i^3\right)$$

$$I_{xy} = -\frac{1}{24}\sum_{i=1}^{n}\left(y_{i+1}-y_i\right)\left[y_{i+1}\left(3x_{i+1}^2+2x_{i+1}\,xi+x_i^2\right)+y_i\left(3x_i^2+2x_{i+1}\,x_i+x_{i+1}^2\right)\right]$$

Koordinati težišča prečnega prereza:

$$x_T = \frac{S_y}{A_x}$$

$$y_T = \frac{S_x}{A_x}$$

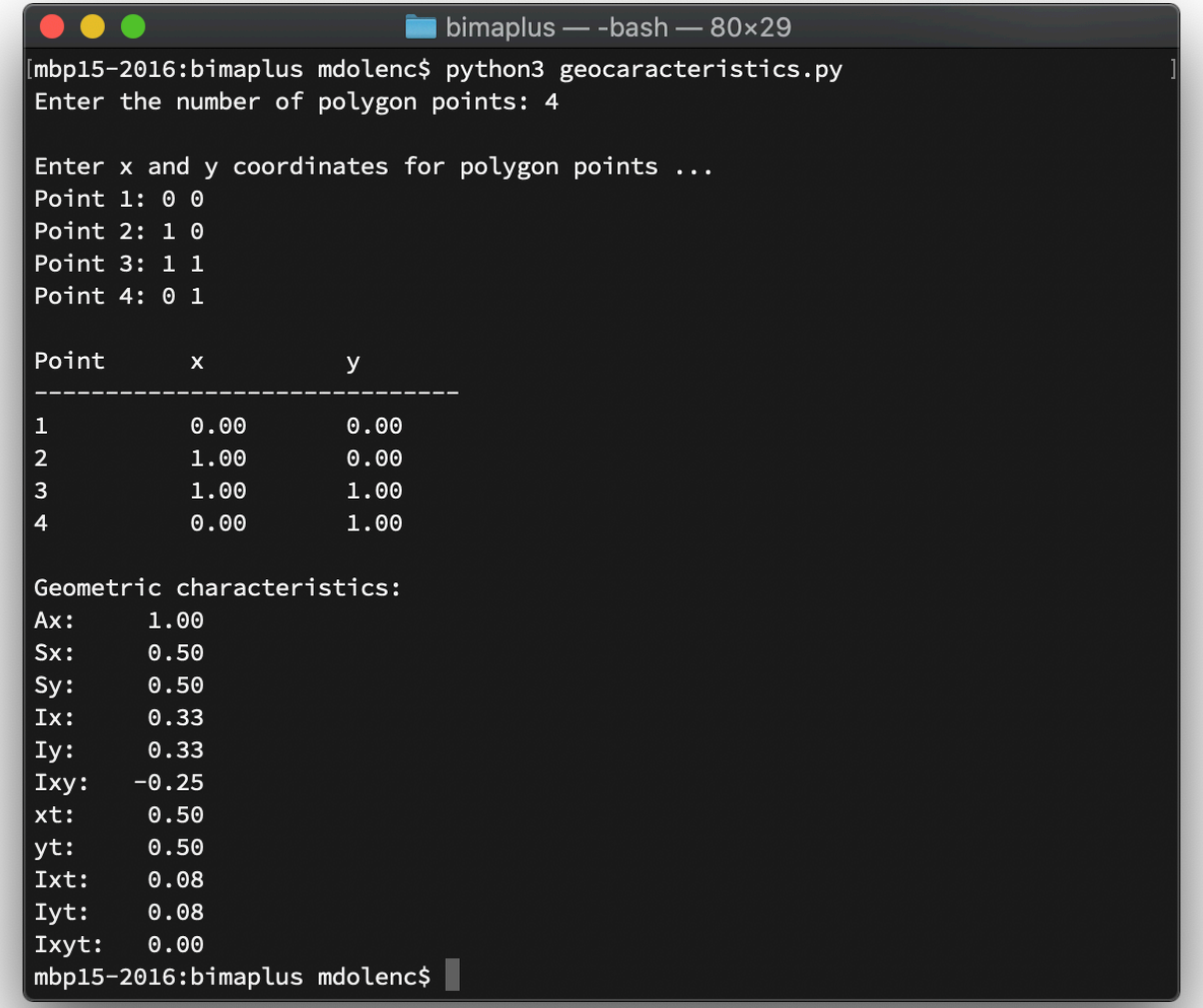
Vztrajnostni momenti glede na vzporedno premaknjeni osi skozi težišče prečnega prereza:

$$I_x^T = I_x - y_T^2 A_x$$

$$I_y^T = I_y - x_T^2 A_x$$

$$I_{xy}^T = I_{xy} + x_T\,y_T\,A_x$$

Formulas


bimaplus — -bash — 80×29
mbp15-2016:bimaplus mdolenc$ python3 geocaracteristics.py
Enter the number of polygon points: 4
Enter x and y coordinates for polygon points ...
Point 1: 0 0
Point 2: 1 0
Point 3: 1 1
Point 4: 0 1
Point x y
1 0.00 0.00
2 1.00 0.00
3 1.00 1.00
4 0.00 0.00
Geometric characteristics:
Ax: 1.00
Sx: 0.50
Sy: 0.50
Ix: 0.33
Iy: 0.33
Ixy: -0.25
xt: 0.50
yt: 0.50
Ixt: 0.08
Iyt: 0.08
Ixyt: 0.00
mbp15-2016:bimaplus mdolenc$