CUSTOMER SUPPORT NOTE

Section Properties for Standard and Arbitrary Sections

Note Number:	**CSN/LUSAS/1018**

This support note is issued as a guideline only.

LUSAS

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1. Introduction

LUSAS can calculate the cross-sectional properties of any section. For standard sections, such as UK sections and parametric sections, the section properties are computed instantaneously once valid user-defined dimensional data have been entered. For arbitrary sections, the *Arbitrary Section Property Calculator* (ASPC) tool can be used. In this technical note, the properties of a solid rectangular section and a circular hollow section are computed.

2. Computation of properties

2.1 Solid rectangular section

A solid rectangular (parametric) section with dimensions 300 mm × 100 mm (where H = 300 mm and B = 100mm) is considered. The properties computed instantaneously by LUSAS are shown in Figure 1. The plastic properties required for nonlinear plastic analysis are also presented.

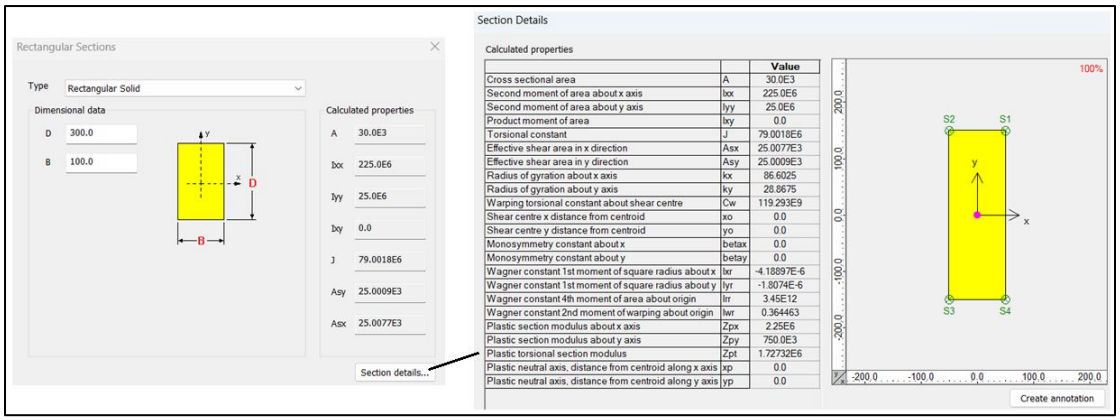


Figure 1 – Section properties: solid rectangular section.

2.2 Circular hollow section

A circular hollow section with an internal radius R_i = 180 mm and an external radius R_o = 200 mm is considered. Its properties can be calculated using the *Arbitrary Section Property Calculator* (ASPC) tool (Attributes > Geometric > Section Calculators > Arbitrary Sections > New). The section may be either imported or manually drawn (Figure 2). In this example, the circular hollow section is created by selecting Standard Shapes > Circular Sections > Hollow.

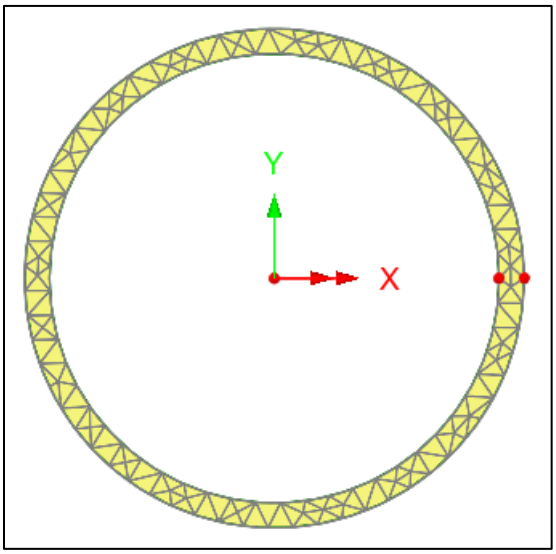
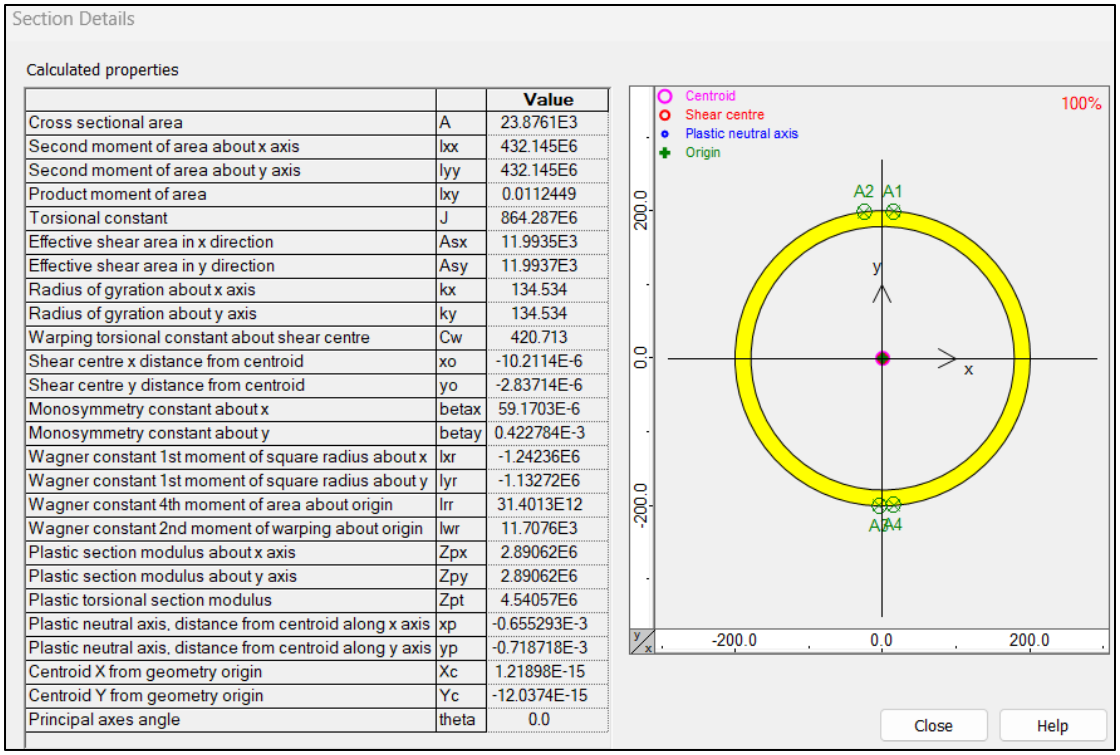


Figure 2 – Discretised circular hollow section.

The discretisation of the section may be refined as required. Once the section has been drawn, its properties can be calculated (Figure 3). The plastic properties required for nonlinear plastic analysis are also provided.



		Value
Cross sectional area	A	23.8761E3
Second moment of area about x axis	Ixx	432.145E6
Second moment of area about y axis	Iyy	432.145E6
Product moment of area	Ixy	0.0112449
Torsional constant	J	864.287E6
Effective shear area in x direction	Asx	11.9935E3
Effective shear area in y direction	Asy	11.9937E3
Radius of gyration about x axis	kx	134.534
Radius of gyration about y axis	ky	134.534
Warping torsional constant about shear centre	Cw	420.713
Shear centre x distance from centroid	xo	-10.2114E-6
Shear centre y distance from centroid	yo	-2.83714E-6
Monosymmetry constant about x	betax	59.1703E-6
Monosymmetry constant about y	betay	0.422784E-3
Wagner constant 1st moment of square radius about x	Ixr	-1.24236E6
Wagner constant 1st moment of square radius about y	Iyr	-1.13272E6
Wagner constant 4th moment of area about origin	Irr	31.4013E12
Wagner constant 2nd moment of warping about origin	Iwr	11.7076E3
Plastic section modulus about x axis	Zpx	2.89062E6
Plastic section modulus about y axis	Zpy	2.89062E6
Plastic torsional section modulus	Zpt	4.54057E6
Plastic neutral axis, distance from centroid along x axis	xp	-0.655293E-3
Plastic neutral axis, distance from centroid along y axis	yp	-0.718718E-3
Centroid X from geometry origin	Xc	1.21898E-15
Centroid Y from geometry origin	Yc	-12.0374E-15
Principal axes angle	theta	0.0

Figure 3 – Section properties: circular hollow section.

3. Summary

LUSAS can calculate the cross-sectional properties of any section. For standard sections, such as UK sections and parametric sections, the section properties are computed instantaneously once valid user-defined dimensional data have been entered. For arbitrary sections, the *Arbitrary Section Property Calculator* (ASPC) tool can be used.

If you have any doubts or require specific advice for your type of analysis, please contact the LUSAS Technical Support team at support@lusas.com.