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Corrigendum

Erratum to “Geometrical and mechanical properties of four species of northern European brown macroalgae”[Coast. Eng. 84 (2014) 73–80]

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This erratum concerns Eq. (1) used in Paul et al. [3] which is the same as Eq. (1) in Paul and Henry [4]. A three-point bending test with clamped ends was performed on macroalga blade samples. As suggested in Fig. 1, this mechanical test was considered by Paul et al. [3] as equivalent to a cantilever with one fixed end and one free end, with a span $s/2$, bending under half the load recorded during a three-point bending test.

Following the classic static, or Euler, beam theory (see e.g. Gere and Goodno [2]), the flexural rigidity of such a free-hanging cantilever is given by

$$J = \frac{Ps^3}{48h} \tag{1}$$

where according to Paul et al. [3], s is the distance between clamped ends of the sample, P the applied force and h the resulting maximal vertical deflection. However, it was a conceptual error to assume equivalency of a three-point bending test with clamped ends and a free-hanging cantilever with half the load. This note aims to correct this conceptual error and clarify the formulation of the flexural rigidity for different set-ups using the basic principles of Euler beam theory.

1. Correct formulation of the flexural rigidity

The flexural rigidity of a beam fixed at both ends with a concentrated load in its center can also be derived from the classic static beam

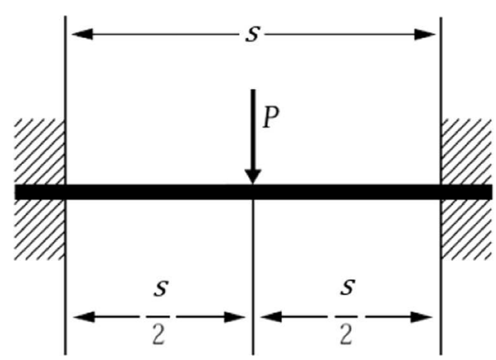

Fig. 2. Parametrisation of a three-point bending test with clamped ends. The notations are the same as defined in Fig. 1. Redrawn and adapted from [1].

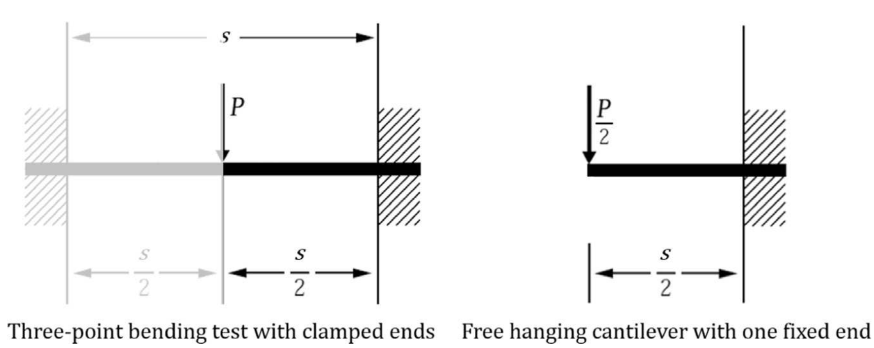

Fig. 1. Sketch of the assumption made by Paul et al. [3]. The shaded area of the 3-point bending test highlights the symmetry of the problem, where P is the applied force and s/2 is the span between the applied force and a support. Redrawn and adapted from [1].

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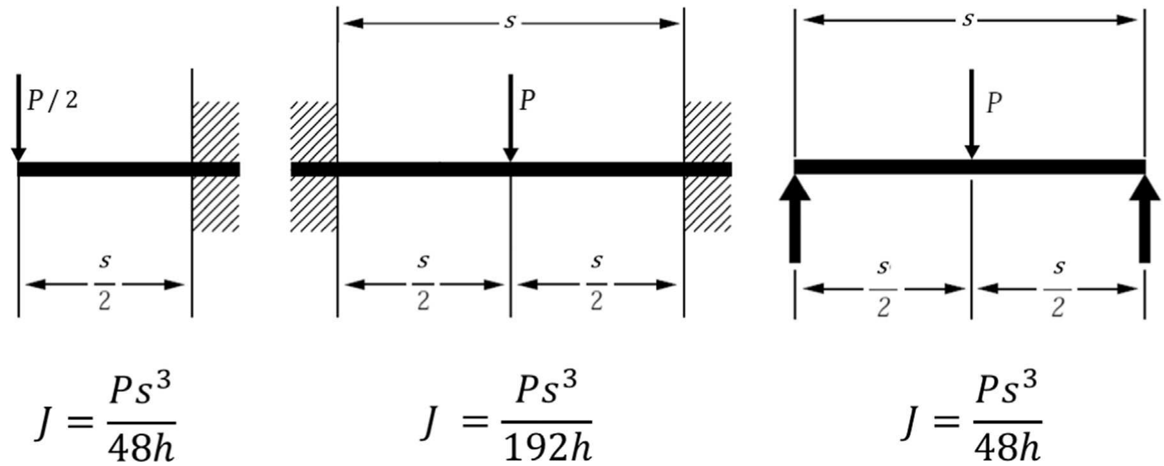

Fig. 3. Reminder of the flexural rigidities J for different test set-ups. From left to right: free hanging cantilever with a fixed end, three-point bending test with clamped ends, and three-point bending test with free ends. As defined earlier, P is the applied force and s/2 is the span between the applied force and a support (span s between two supports). Redrawn and adapted from [1].

theory, and is often found in beam design manuals such as [1]. Consider a clamped beam loaded at its center with a point force P (Fig. 2), the correct formulation of the flexural rigidity J for such a set-up is:

$$J = \frac{Ps^3}{192h} \tag{2}$$

2. Consequences for the work of Paul et al. [3] and Paul and Henry [4]

It will be noted that Eqs. (1) and (2) differ by a factor 4. As a consequence, the flexural rigidities and Young's tangent moduli obtained for macroalga blade samples by Paul et al. [3] (Tables 1 & 2, Fig.5 and throughout the text) and Paul and Henry [4] (Table 1 and throughout the text) should be divided by 4. Although absolute values are impacted by this error, relative values are not and so the discussion of results and the scientific conclusions of both Paul et al. [3] and Paul and Henry [4] are not affected and are still valid.

To prevent similar error in futur works, Fig. 3 gives a reminder of three common set-up use to characterise the bending properties of a beam, and details the correct formulations to compute the flexural rigidity of these different tests. These results can readily be derived from Euler's beam theory.

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