Quantifying Shear:
Angular Shear Strain & Shear Strain

When objects or particles within an object or fluid pass by each other, we say shearing has occurred. Shearing creates changes in angles between lines within an object, so we can quantify shearing using what is called angular shear strain, which is a measure of changes in angles between lines within a distorted body. It is measured with respect to a line. In all the examples below, it is measured with respect to line A. In each example, the shear strain along line A is the change in the angle between line A and a line that was perpendicular to A before the strain occurred. In the examples, line B was perpendicular to line A before the strain event. Remember, the angle between A and B is what counts - any rotation of both A and B relative to some other frame of reference (e.g., north), is a rigid-body rotation, not shear strain. And don’t forget that pure shear and simple shear cause shear strain to occur in rocks.

In the examples below, the undeformed arrangement of lines A and B is shown in the left column and the arrangement after deformation is shown on the right. The angular shear strain, \( \psi \) (psi), is noted for each example on the right side. Shear strain is the tangent to the angular shear strain and is usually called \( \gamma \) (gamma). Clockwise shear is called dextral and by convention is positive. Anti-clockwise is called sinistral and by convention is negative.

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**Example 1**

Before

\[ \psi = -30^\circ \]

After

\[ \psi = -30^\circ \]

sinistral

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**Example 2**

Before

After

\[ \psi = +30^\circ \]

dextral

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**Example 3**

Before

After

\[ \psi = +30^\circ \]

(plus a rigid-body rotation)

dextral

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**Example 4**

Before

After

\[ \psi = -30^\circ \]

(plus a rigid-body rotation)

sinistral

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