3.13 Scalar product

Checklist

What you should know

By the end of this subtopic you should be able to:

- define the scalar product as directional multiplication of vectors:

$$v \cdot w = v_1 \cdot w_1 + v_2 \cdot w_2 + v_3 \cdot w_3, \text{ where } v = \begin{pmatrix} v_1 \\ v_2 \\ v_3 \end{pmatrix} w = \begin{pmatrix} w_1 \\ w_2 \\ w_3 \end{pmatrix}$$

- define the scalar product as the projection of one vector onto another: $v \cdot w = |v||w| \cos \theta$, where θ is the angle between the vectors v and w
- recall that for, two vectors a and b, the scalar product is:
  - commutative: $a \cdot b = b \cdot a$
  - distributive for addition and subtraction: $a \cdot (b \pm c) = a \cdot b \pm a \cdot c$
- recall that when a scalar product is multiplied by a scalar number m, $m(a \cdot b) = a \cdot (mb)$
- use $b \cdot b = |b|^2$
- recall that if $a \cdot b = 0$, then a and b are perpendicular and, conversely, if a and b are perpendicular, then $a \cdot b = 0$
- recall that if v and w are parallel, then $v \cdot w = |v||w|$.

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