integral balance
control domain
physical domain
flux

Chapter 1

Integral Balances

$\overline{\mathcal{G}}^{\textcircled{n}}$

Let $\overline{\mathfrak{g}}^{\textcircled{n}}$ be a tensor field of order n for which we want to write the **integral balance** over a domain.

1. There will be two cases depending on whether the domain is

- A geometric **control domain** D that is fixed relative to the referential,
- A frozen, **physical domain** $\mathcal{D}$ that we follow in its motion.

2. Given a tensor field $\overline{\mathfrak{g}}^{\textcircled{n}}$, we define the tensor fields

$$\overline{\mathcal{G}}^{\textcircled{n}} = \iiint \overline{\mathfrak{g}}^{\textcircled{n}} \, dv$$

$$\overline{\mathcal{F}}^{\textcircled{n}} = \iint \overline{\mathfrak{g}}^{\textcircled{n}} \otimes U \cdot n ds \qquad \text{(The } \textbf{flux} \text{ of the tensor field } \overline{\mathfrak{g}}^{\textcircled{n}}\text{)}$$

where the integrals are taken, depending on the case, on D, S or $\mathcal{D}$

3. Depending on whether the domain is a geometric control domain or a frozen physical domain, we will have to evaluate the following quantity:

- In the case of a geometric control domain,

$$\frac{d}{dt}\overline{\mathcal{G}}^{\textcircled{n}}_{D} + \overline{\mathcal{F}}^{\textcircled{n}}_{S}$$

- In the case of a frozen physical domain

$$\frac{D}{Dt}\overline{\mathcal{G}}^{\textcircled{n}}_{\mathcal{D}}$$

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