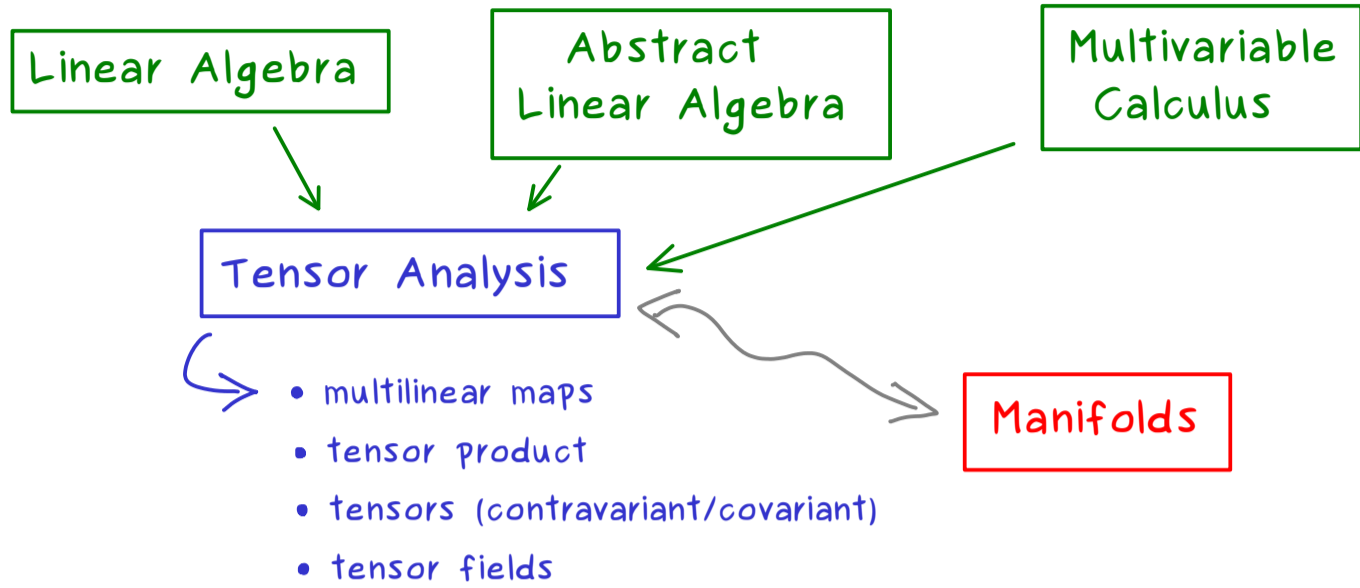


Tensor Analysis - Part 1



Roughly explained concept:

	concrete (w.r.t. a basis)	abstract
	$\begin{pmatrix} x^1 \\ x^2 \\ \vdots \\ x^n \end{pmatrix} \in \mathbb{R}^n$	vector $v \in V$
matrix	$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ \vdots & \ddots & & \vdots \\ a_{m1} & \dots & & a_{mn} \end{pmatrix}$	linear map $\ell: V \rightarrow W$
components	$\psi_{j_1 j_2 \dots j_n}^i$	multilinear map $\psi: \underbrace{V \times V \times \dots \times V}_{n \text{ times}} \rightarrow W$
components	$\psi_{j_1 j_2 \dots j_n}^{i_1 i_2 \dots i_m}$	multilinear map $\psi: \underbrace{V^* \times \dots \times V^*}_{\substack{\uparrow \\ \text{dual space}}} \times V \times \dots \times V \rightarrow \mathbb{R}$
	tensors	tensors

Example: $\epsilon_{j_1 j_2 j_3}$ Levi-Civita tensor (on $\{1, 2, 3\}$): $\epsilon_{j_1 j_2 j_3} := \begin{cases} 1, & (j_1, j_2, j_3) \text{ even permutation} \\ -1, & (j_1, j_2, j_3) \text{ odd permutation} \\ 0, & \text{else} \end{cases}$

for example: $(2, 1, 3)$ odd permutation

Visualization:

