

tmech: a C++ library for the numerical analysis
of physical effects with symbolic compile time
differentiation.

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Contents

Motivation

tmech: tensor

tmech: symdiff

Motivation

- ▶ Linear algebra

- ▶ Eigen

- ```
Eigen::Mat<double> A(rows,cols), B(rows,cols);
```

- ```
... fill A and B
```

- ```
Eigen::Mat<double> C = A*B;
```

- ```
... do something with C
```

- ▶ Armadillo

- ▶ Balze

- ▶ many more

- ▶ "Tensors" by means multi-dimensional array (more for machine learning...)

- ▶ Tensorflow

- ▶ xTensor

- ▶ Tensor algebra: tmech

- ```
tmech::tensor<Type,Dim,Rank> a, b, c;
```

- ```
c = 2*a + b;
```

Basic operations

```
tmech::tensor<double,Dim,Rank> a, b, c; c = 2*a + b;
```

Outer product

Let \mathbf{A} and \mathbf{B} be $n \times m$ and $m \times p$ matrices, respectively. Then the outer product of \mathbf{A} and \mathbf{B} is the $n \times p$ matrix \mathbf{C} defined by

$$C_{ij} = \sum_{k=1}^m A_{ik} B_{kj}$$

or, equivalently, $\mathbf{C} = \mathbf{A} \mathbf{B}$.

The outer product of two vectors \mathbf{u} and \mathbf{v} is the matrix \mathbf{C} defined by

$$C_{ij} = u_i v_j$$

or, equivalently, $\mathbf{C} = \mathbf{u} \mathbf{v}^T$.

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Inner product

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Definition