Homework #4 **Deadline: April 22, 2020, 12:00.**

1. Assume that $\mathbb{A}$ is an objective tensor. Decide if the following generalized time derivative of $\mathbb{A}$ is objective:

$$\overset{\circ}{\mathbb{A}} := \frac{\mathrm{d}\mathbb{A}}{\mathrm{d}t} - \boldsymbol{\Omega}\mathbb{A} + \mathbb{A}\boldsymbol{\Omega},$$

where $\boldsymbol{\Omega} = \dot{\mathbb{R}}\mathbb{R}^T$ a $\mathbb{R}$ is a tensor of rotation from the polar decomposition of the deformation gradient.

2. Show that for the incompressible fluid the principle (assumption) of the maximization of the rate of entropy production (dissipation) applied to the following three situations:

(a) $\xi = 2\mu_* |\mathbb{D}|^r$ & $\xi(\mathbb{D}) = \mathbb{T} \cdot \mathbb{D}$ & maximize w.r.t. $\mathbb{D}$

(b) $\xi = \dfrac{1}{2\alpha_*} |\mathbb{T}^d|^{r'}$ & $\xi(\mathbb{T}^d) = \mathbb{T} \cdot \mathbb{D}$ & maximize w.r.t. $\mathbb{T}^d$

(c) $\xi = \dfrac{1}{2\mu_* |\mathbb{D}|^{r-2}} |\mathbb{T}^d|^2$ & $\xi_{\mathbb{D}}(\mathbb{T}^d) = \mathbb{T} \cdot \mathbb{D}$ & maximize w.r.t. $\mathbb{T}^d$

leads to the same constitutive equation, namely

$$\mathbb{T} = m\mathbb{I} + 2\mu_* |\mathbb{D}|^{r-2}\mathbb{D}.$$

What is the relation between α_* and μ_* (both are positive constants)?