- **Def. 3.19: Raviart-Thomas FE**

The lowest order tetrahedral Raviart-Thomas FE is given by

- a tetrahedron T,
- the local FE-space $RT_0 := \{ v = a + bx : a \in \mathbb{R}^3, b \in \mathbb{R} \}$,
- the functionals

$$\psi_{F_{\alpha\beta\gamma}} : v \longrightarrow \int_{F_{\alpha\beta\gamma}} v \cdot n \, ds$$

associated with the 4 faces $F_{\alpha\beta\gamma}$ of the tetrahedron T.

- **Properties 3.20: of the Raviart-Thomas FE-space**

1. The nodal basis function $\varphi_{\alpha\beta\gamma}$ associated with the face $F_{\alpha\beta\gamma}$ of the tetrahedron T is given by

$$(18) \quad \varphi_{\alpha\beta\gamma} = \lambda_\alpha \nabla\lambda_\beta \times \nabla\lambda_\gamma + \lambda_\beta \nabla\lambda_\gamma \times \nabla\lambda_\alpha + \lambda_\gamma \nabla\lambda_\alpha \times \nabla\lambda_\beta .$$

2. $[P_0]^3 \subset RT_0 \subset [P_1]^3$
3. $\operatorname{div} RT_0 = P_0$
4. The normal components on the faces are constant.
5. $\operatorname{curl} \mathcal{N}_0 = \{ v \in RT_0 : \operatorname{div} v = 0 \}$
6. $R_h := \{ v \in L_2(\Omega)^3 : v|_T \in RT_0 \wedge (\psi_{F_{\alpha\beta\gamma}} \equiv \psi_{\tilde{F}_{\tilde{\alpha}\tilde{\beta}\tilde{\gamma}}} \Rightarrow \psi_{F_{\alpha\beta\gamma}}(v|_T) = \psi_{\tilde{F}_{\tilde{\alpha}\tilde{\beta}\tilde{\gamma}}}(v|_{\tilde{T}})) \} \subset H(\operatorname{div})$.