

T U T O R I A L

“Computational Mechanics”

to the lecture

“Numerical Methods in Continuum Mechanics 1”

Tutorial 09

Date: Thursday, 9 June 2016

Time : 10¹⁵ – 11⁰⁰

Room : K 001A

25 Which iteration error estimates do you know for the preconditioned Richardson method (3.33) considered in Exercise 22 !

26 Provide the detailed (i.e. for the iterates \underline{u}_k and $\underline{\lambda}_k$) algorithm of the so-called Bramble-Pasciak-PCG which is nothing else but the preconditioned (with \bar{S}) CG for solving system $S\underline{X} = \underline{F}$ (this is system (61) from Chapter 2 of the Lectures), where

$$\bar{S} = \begin{pmatrix} A - A_0 & 0 \\ 0 & D \end{pmatrix}.$$

Hint: The preconditioning equation $\bar{S}\underline{W} = \underline{R}$ has the residual (defect)

$$\underline{R} = \underline{F} - S\underline{X} = \begin{pmatrix} (A - A_0)A_0^{-1}(\underline{f} - A\underline{u} - B^T\underline{\lambda}) \\ B[A_0^{-1}(\underline{f} - A\underline{u} - B^T\underline{\lambda}) + \underline{u}] - C\underline{\lambda} - \underline{g} \end{pmatrix}. \quad (3.37)$$

The right-hand side shows that the inversion of $A - A_0$ is not necessary (see also Exercise 2.24 from Chapter 2 of the Lecture) !

27 Provide the corresponding iteration error estimate for the Bramble-Pasciak-PCG from Exercise 26 !