Algorithm   *Preconditioned BiCGStab*

1: $r_0 = b - Ax_0$

2: **for** $i = 1, 2, \ldots$ until convergence **do**

3:      **if** $i == 1$ **then**

4:          $p_i = r_{i-1}$

5:      **else**

6:          $\beta = \dfrac{\overbrace{(\bar{r}_0, r_{i-1})}^{\delta_i}}{\underbrace{(\bar{r}_0, r_{i-2})}_{\delta_{i-1}}} \cdot \dfrac{\alpha_{i-1}}{\omega_{i-1}}$

7:          $p_i = r_{i-1} + \beta p_{i-1} - \omega_{i-1} \underbrace{A\widetilde{p}_{i-1}}_{v_{i-1}}$ $\triangleright \; p_i \neq 0$

8:      **end if**

9:      $\widetilde{p}_i = M^{-1} p_i = M_U^{-1} M_L^{-1} p_i$

10:      $\alpha_i = \dfrac{\overbrace{(\bar{r}_0, r_{i-1})}^{\delta_i}}{\underbrace{(\bar{r}_0, A\widetilde{p}_i)}_{v_i}}$

11:      $x_i = x_{i-1} + \alpha_i \widetilde{p}_i$

12:      $s = r_{i-1} - \alpha_i \underbrace{A\widetilde{p}_i}_{v_i}$

13:      check the convergence of s. If converge, **return**

14:      $\widetilde{s} = M_U^{-1} M_L^{-1} s$

15:      $\omega_i = \dfrac{(A\widetilde{s}, s)}{(A\widetilde{s}, \underbrace{A\widetilde{s}}_{t})}$ $\triangleright \; omega \neq 0$

16:      $x_i = x_i + \omega_i \widetilde{s}$

17:      $r_i = s - \omega_i \underbrace{A\widetilde{s}}_{t}$

18:      check the convergence of r_i. If converge, **return**

19: **end for**