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**Iterative Calculation of the Functions
 p & $T(h,s)$ Using
IAPWS-IF97 Basic and Backward Equations**

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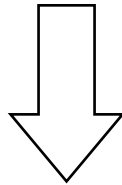
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Introduction

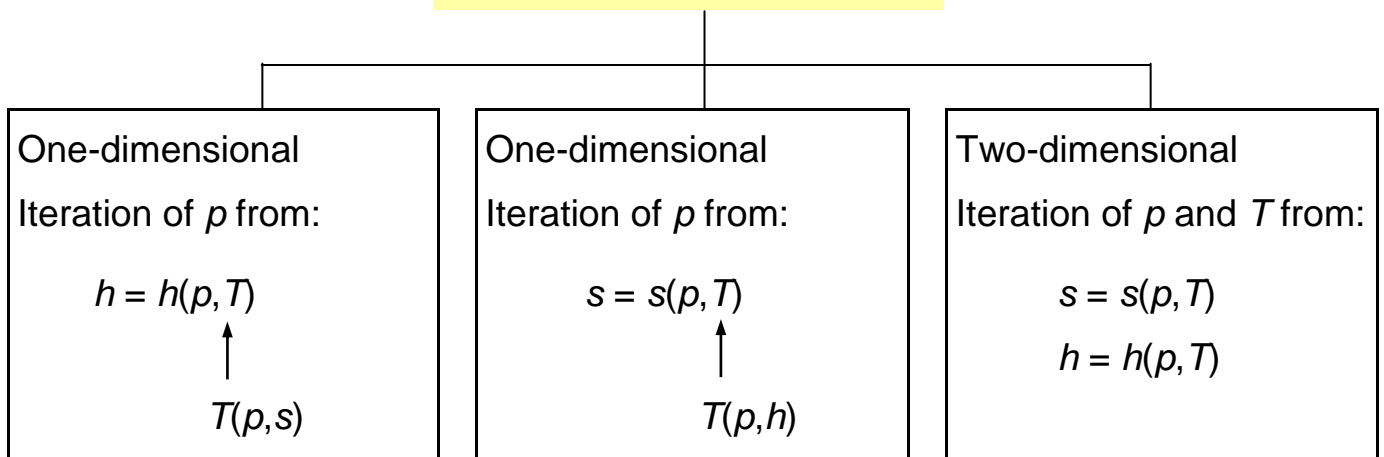
- Last year in Prag, the draft of the supplementary release on the $p(h,s)$ backward equations was presented.
- During the evaluation of the $p(h,s)$ backward equations, comparison calculations were carried out to calculate $p&T(h,s)$ using IAPWS-IF97 basic and backward equations.



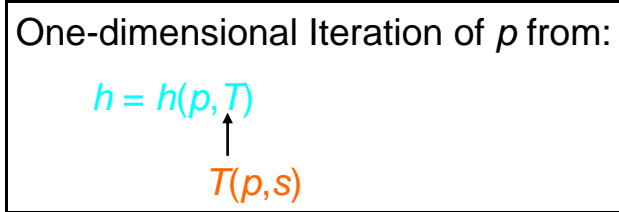
A specific problem was found
when using the IAPWS-IF97 backward equations
in iterations.

Iterative Calculation of p & $T(h,s)$ Using IF97 Equations Only

Iteration Variants

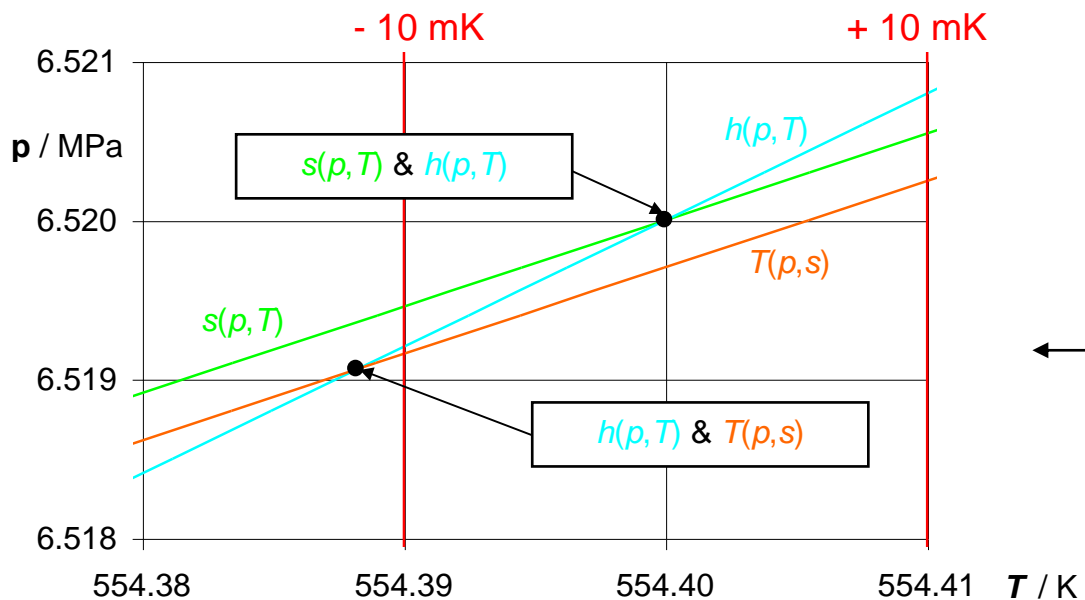


Results for Obtained Numerical Consistencies of Iteration from $h(p, T)$ & $T(p, s)$



Region	Δp_{tol}	$ \Delta p _{\text{max}}$	ΔT_{tol}	$ \Delta T _{\text{max}}$
1	$p \leq 2.5 \text{ MPa}$	0.6 %	25 mK	143.1 mK
	$p > 2.5 \text{ MPa}$	15 kPa		
2a	0.0035 %	0.013 %	10 mK	5.0 mK
2b	0.0035 %	0.016 %	10 mK	12.8 mK
2c	0.0088 %	0.126 %	25 mK	144.6 mK

Iteration accuracy: $\Delta h = 1 \times 10^{-10}$



Results for Obtained Numerical Consistencies of Iteration from $s(p, T)$ & $T(p, h)$

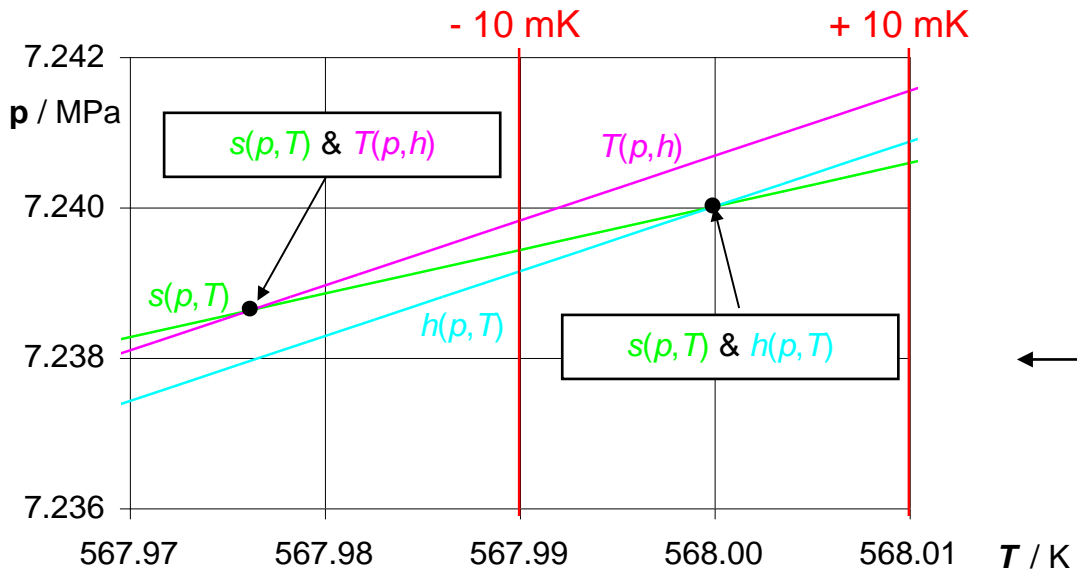
One-dimensional Iteration of p from:

$$s = s(p, T)$$

↑
 $T(p, h)$

Region	Δp_{tol}	$ \Delta p _{\text{max}}$	ΔT_{tol}	$ \Delta T _{\text{max}}$
1 $p \leq 2.5$ MPa	0.6 %	2433 %	25 mK	199.9 mK
$p > 2.5$ MPa	15 kPa	246 kPa		
2a	0.0035 %	0.018 %	10 mK	20.2 mK
2b	0.0035 %	0.023 %	10 mK	28.9 mK
2c	0.0088 %	0.263 %	25 mK	324.4 mK

Iteration accuracy: $\Delta s = 1 \times 10^{-10}$



Results for Obtained Numerical Consistencies of Iteration from $s(p, T)$ & $T(p, h)$

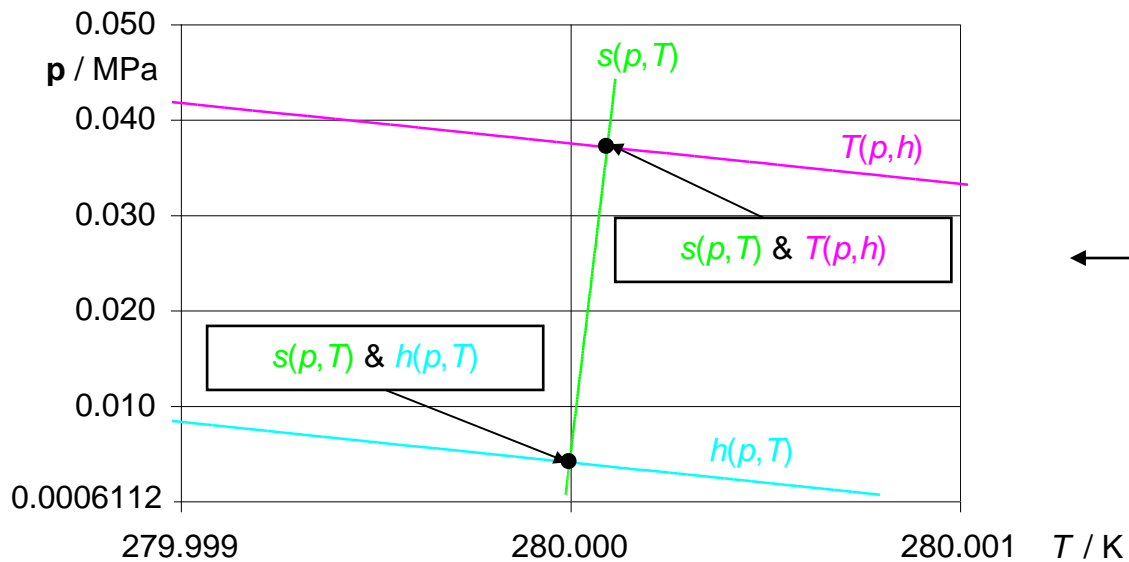
One-dimensional Iteration of p from:

$$s = s(p, T)$$

↑
 $T(p, h)$

Region	Δp_{tol}	$ \Delta p _{\text{max}}$	ΔT_{tol}	$ \Delta T _{\text{max}}$
1 $p \leq 2.5$ MPa $p > 2.5$ MPa	0.6 %	2433 %	25 mK	199.9 mK
	15 kPa	246 kPa		
2a	0.0035 %	0.018 %	10 mK	20.2 mK
2b	0.0035 %	0.023 %	10 mK	28.9 mK
2c	0.0088 %	0.263 %	25 mK	324.4 mK

Iteration accuracy: $\Delta s = 1 \times 10^{-10}$



Results for Obtained Numerical Consistencies of Iteration from $s(p, T)$ & $h(p, T)$

Two-dimensional Iteration of p and T from:

$$s = s(p, T)$$

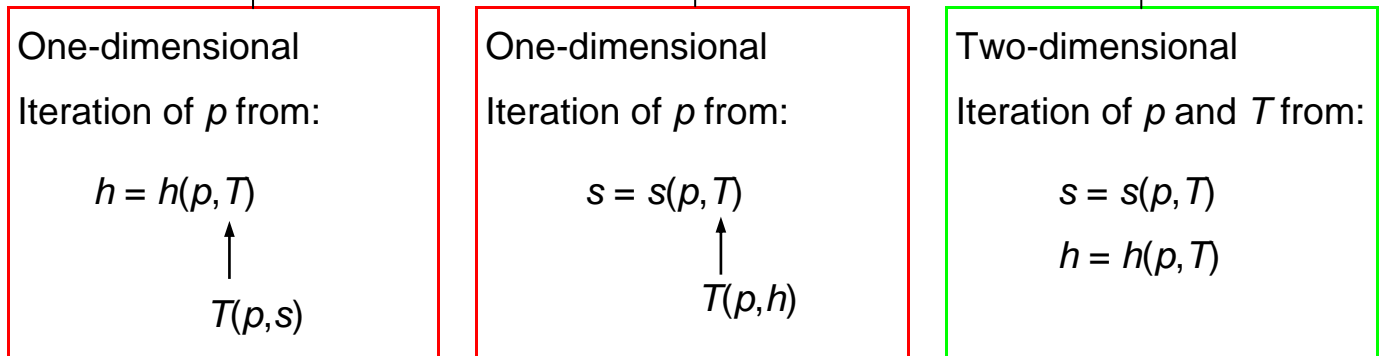
$$h = h(p, T)$$

Iteration from $s(p, T)$ & $h(p, T)$					
Region	Δp_{tol}	$ \Delta p _{\text{max}}$	ΔT_{tol}	$ \Delta T _{\text{max}} / \text{mK}$	
1	$p \leq 2.5 \text{ MPa}$	0.6 %	$4.4 \times 10^{-5} \%$	25 mK	5.4×10^{-8}
	$p > 2.5 \text{ MPa}$	15 kPa	$4.4 \times 10^{-3} \text{ kPa}$		
2a	0.0035 %	$6.5 \times 10^{-10} \%$	10 mK	1.5×10^{-11}	
2b	0.0035 %	$4.6 \times 10^{-9} \%$	10 mK	2.0×10^{-9}	
2c	0.0088 %	$5.2 \times 10^{-8} \%$	25 mK	4.7×10^{-8}	

Iteration accuracy: $\Delta p = \Delta p_{\text{tol}}$, $\Delta T = \Delta T_{\text{tol}}$

Conclusion

Iteration Variants



The iterated p and T exceed the permissible values in Region 1 and all subregions of region 2.

The iterated p and T meet the permissible values resulting from the iteration accuracy.