

FWI for Ultrasonic Imaging

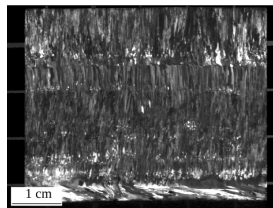
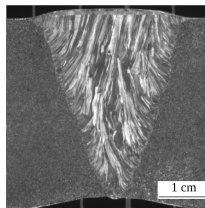
Flaw detection in steel weld

Alice DINSENMEYER

supervised by
Romain BROSSIER & Ludovic MOREAU

June 9, 2016

NDT for Welds

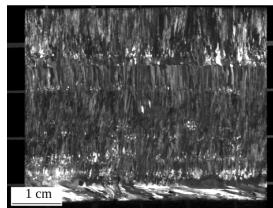
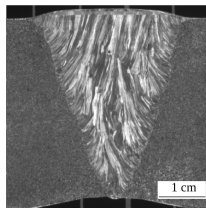


Pictures from Chassignole 2000, PhD thesis

- delay and sum methods
- SVD decomposition of covariance matrix

- ▶ contour reconstruction : *Dominguez et al., Rodriguez et al.*
- ▶ cartography : FWI

NDT for Welds



Pictures from Chassignole 2000, PhD thesis

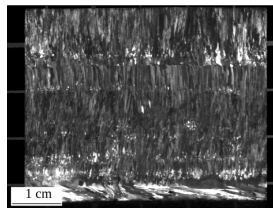
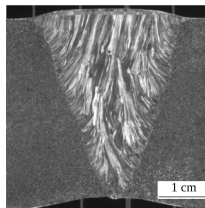
- delay and sum methods
- SVD decomposition of covariance matrix



- ✗ need to know c in advance
- ✗ strong artefacts

- ▶ contour reconstruction : *Dominguez et al., Rodriguez et al.*
- ▶ cartography : FWI

NDT for Welds



Pictures from Chassignole 2000, PhD thesis

- delay and sum methods
- SVD decomposition of covariance matrix



- ✗ need to know c in advance
- ✗ strong artefacts

- solving NL optimization problem

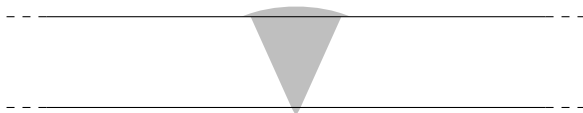


- ✓ elastic parameters reconstruction

- ▶ contour reconstruction : *Dominguez et al., Rodriguez et al.*
- ▶ cartography : FWI

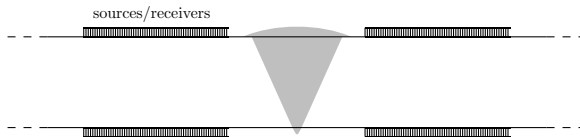
What is specific to weld imaging ?

- ▶ 2 free surfaces : more information \leftrightarrow more non-linearities



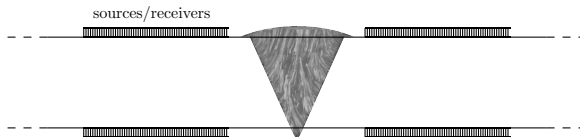
What is specific to weld imaging ?

- ▶ 2 free surfaces : more information \leftrightarrow more non-linearities
- ▶ surface acquisition only



What is specific to weld imaging ?

- ▶ 2 free surfaces : more information \leftrightarrow more non-linearities
- ▶ surface acquisition only
- ▶ anisotropy \rightarrow multi-parameter inversion ($C_{ij} \times 6$)



To do

- ▶ acoustic approximation (mono/multiparameter)
 - ▶ isotropic weld (v_p, ρ)
 - ▶ VTI weld ($v_p, \rho, \epsilon, \delta$)
 - ▶ TTI weld ($v_p, \rho, \epsilon, \delta, \theta$)

To do

- ▶ acoustic approximation (mono/multiparameter)
 - ▶ isotropic weld (v_p, ρ)
 - ▶ VTI weld ($v_p, \rho, \epsilon, \delta$)
 - ▶ TTI weld ($v_p, \rho, \epsilon, \delta, \theta$)
- ▶ elastic inversion (mono/multiparameter : $C_{ij} \times 6$)
 - ▶ isotropic weld
 - ▶ anisotropic weld
 - ▶ true data

Ongoing work

- ▶ acoustic approximation (mono/multiparameter)
 - ▶ isotropic weld (v_p , ρ)
 - ▶ VTI weld (v_p , ρ , ϵ , δ)
 - ▶ TTI weld (v_p , ρ , ϵ , δ , θ)

Ongoing work

- ▶ acoustic approximation (mono/multiparameter)
 - ▶ isotropic weld (v_p , ρ)
 - ▶ VTI weld (v_p , ρ , ϵ , δ)
 - ▶ TTI weld (v_p , ρ , ϵ , δ , θ)
- ▶ elastic inversion (mono/multiparameter : $C_{ij} \times 6$)
 - ▶ isotropic weld
 - ▶ anisotropic weld
 - ▶ true data