



Werk en loopbaan

Tjeert ten Wolde
CPR Vlietstreek
9 juli 2024

Afstuderen en promotie

- 1960: Afstudeerrichting Akoestiek
- 1962: Ir.
- 1973: Dr.

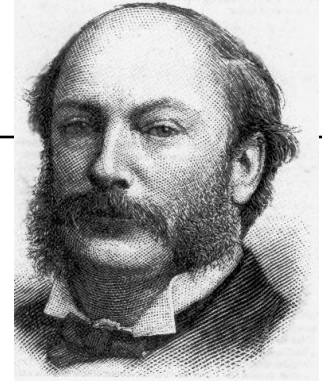
Loopbaan

- 1961 : Student-medewerker TPD (Technisch Fysische Dienst TNO-TH)
- 1962-1964: KMR bij Bureau Scheepsbouw en TPD
- 1964-1972: wetenschappelijk medewerker TPD
- 1972-1987: afdelingshoofd, projectleider en weer afdelingshoofd
- 1987-1996: hoofd Divisie Geluid
- 1996-2001: senior wetenschappelijk medewerker
 - 1998-2001: beleidsmedewerker Europese Commissie
- 2001 : pensioen

TPD

- Technisch Physische Dienst TNO-TH
 - Geluid
 - Warmte
 - Optica
 - Instrumentatie
- Medewerkers: 1961: 100; 2001: 500
- Non-profit: 80-90% uit opdrachten

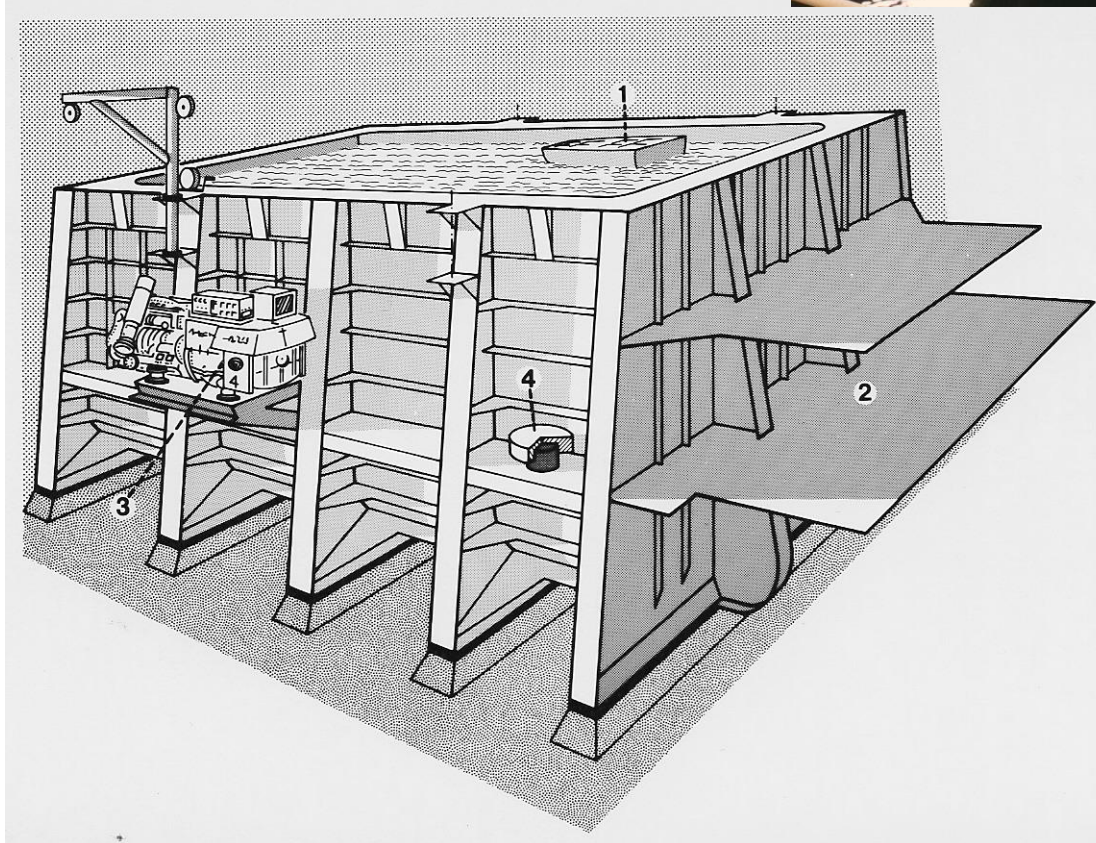
Technische middelen Geluid 1960 – ca.1980



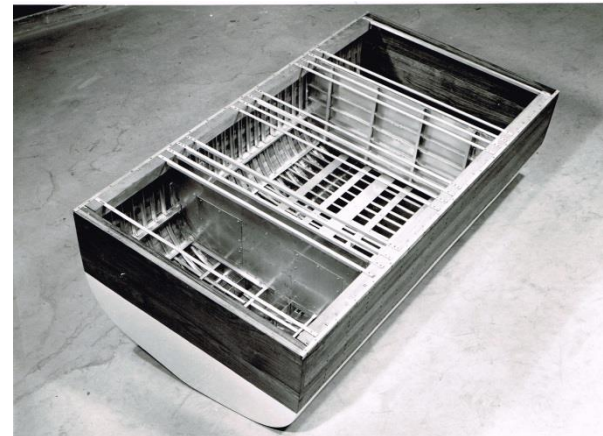
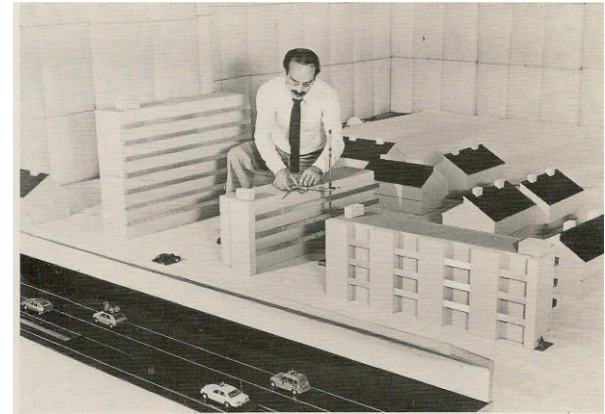
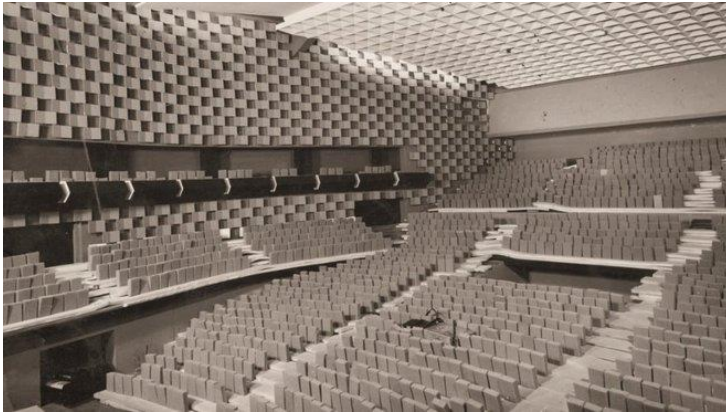
Lord Rayleigh

- Theorie
- Rekenlineaal
- Meten
- Akoestische meetruimten
 - Dode kamer, galmkamer, isolatiekamers, **galmbassin**
- **Schaalmodellen**
- **Reciproke meetmethoden**

Galmbassin



Schaalmodellen



Ca. 1970: Reciproke metingen

Trillingoverdracht van A naar B =
trillingoverdracht van B naar A

Tot 1973 weinig toepassingen in
de akoestische meettechniek.



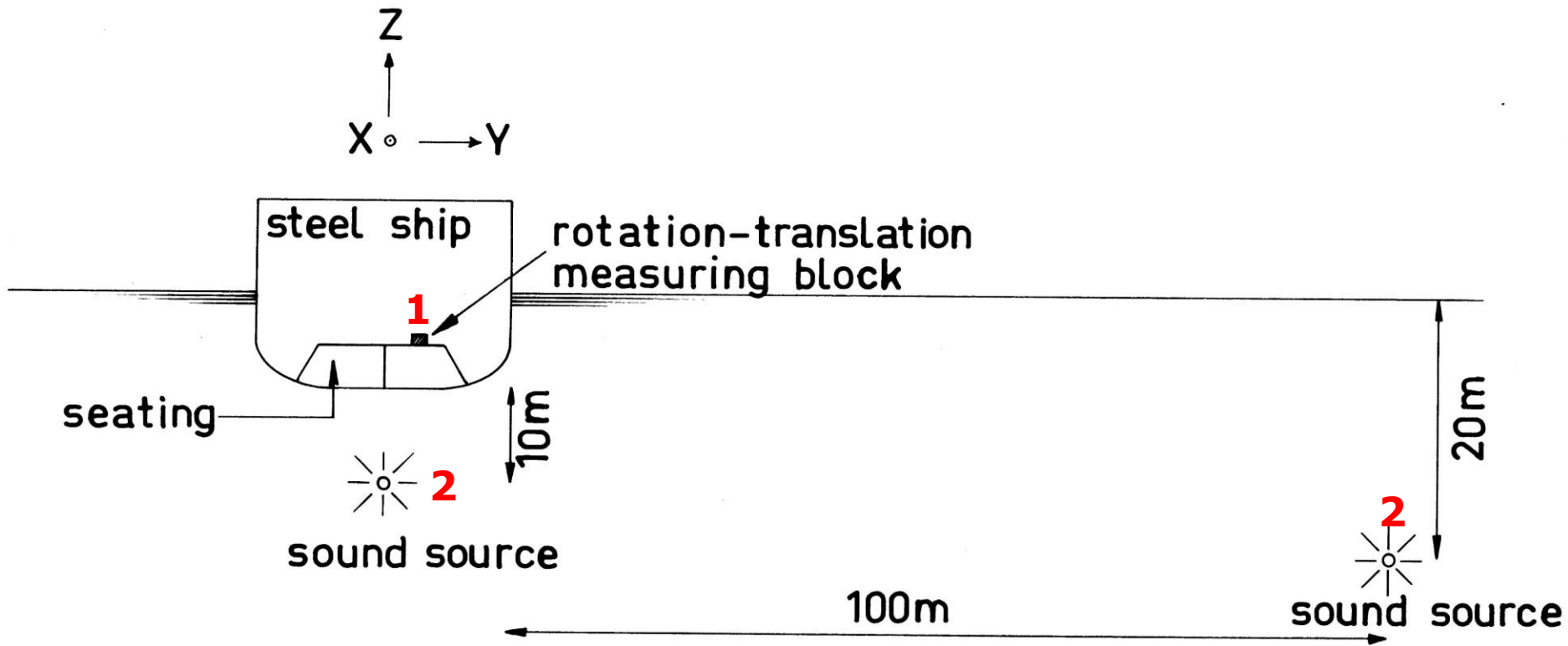
Onderwerpen waaraan ik werkte

- Verbetering van de nagalmmethode ter bepaling van de geluidabsorptie van materialen
- Vermindering van het onderwatergeluid van oorlogsschepen
- Ontwikkeling van reciproke meetmethoden
- Vermindering van de sonarreflectie van onderzeeboten
- Optimaliseren van het positioneringssysteem van een boorschip
- Ontwikkeling van een bewakingssysteem voor natriumpompen
- Ontwikkeling van rekenmethoden voor de bepaling van het lawaai in de woonomgeving
- Vermindering van het lawaai van railvoertuigen
- Beleidsstudie vermindering van het lawaai op de arbeidsplaats
- Beleidsstudie verminderen lawaai van geluidsbronnen
- Relatie TNO en Universiteiten
- Europese Richtlijnen voor het verminderen van lawaai

Metingen in Schotland

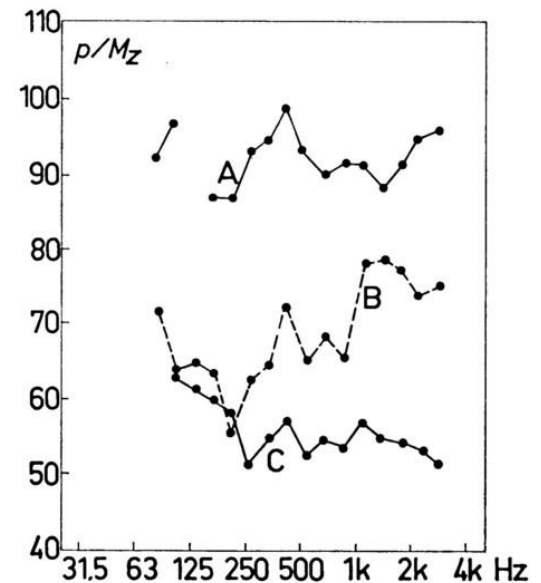
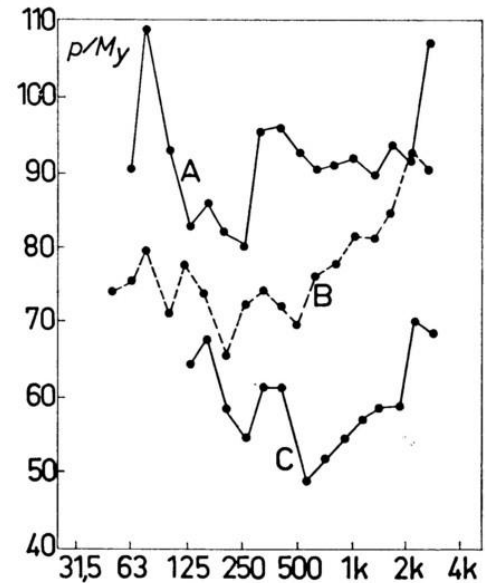
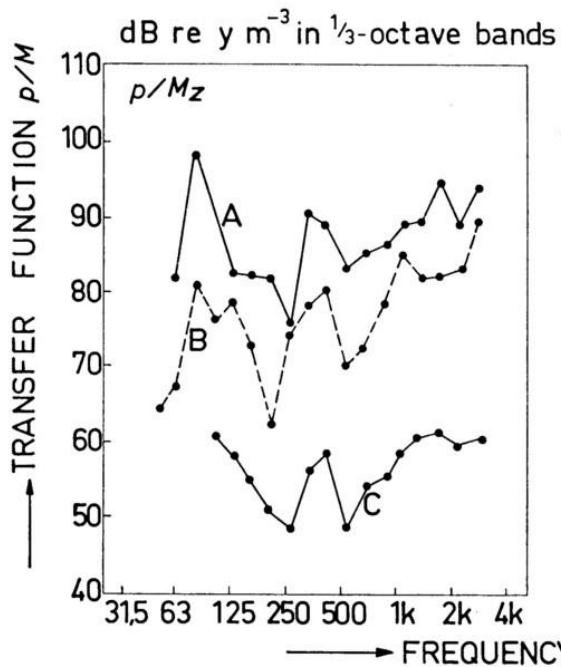
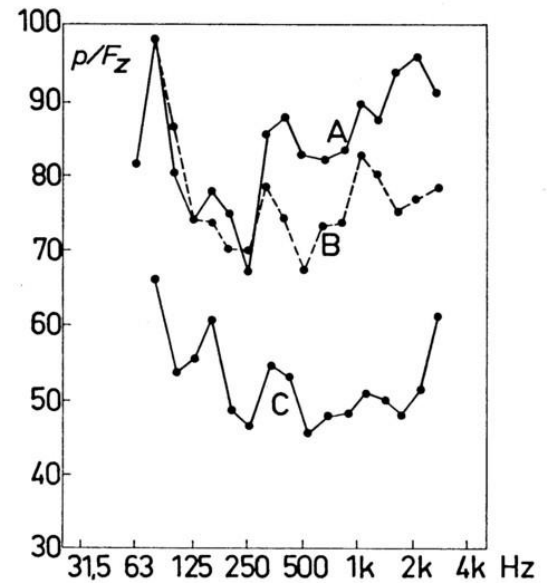
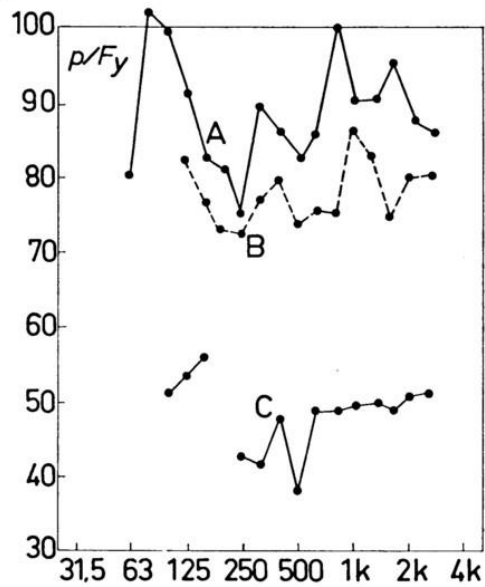
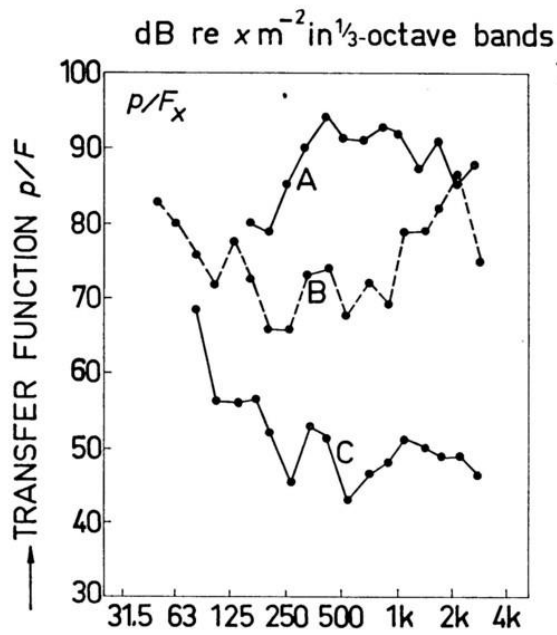


HMS Penelope
Loch Fyne
Nov./Dec. 1970

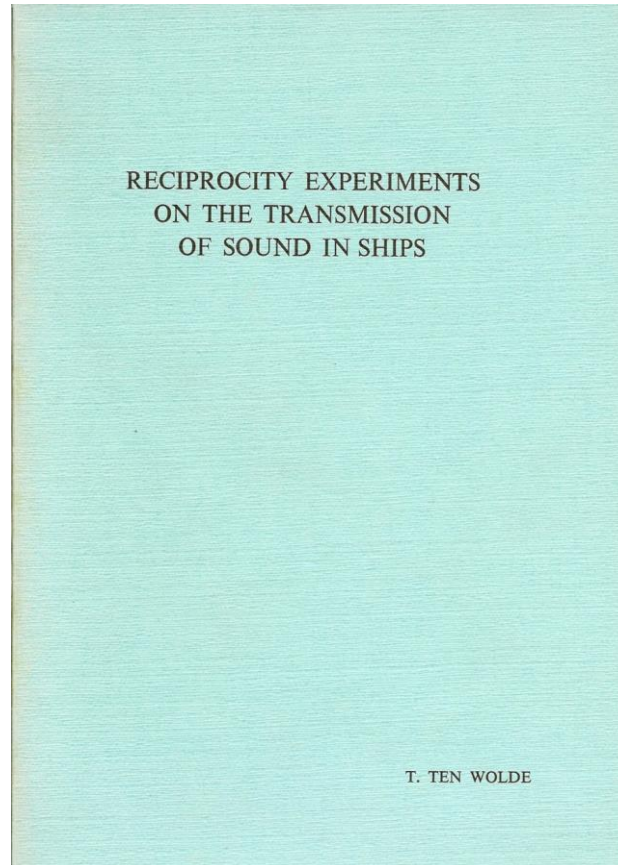


$$\begin{pmatrix} p_2' \\ F_{x1}' \end{pmatrix} = \begin{pmatrix} v_{x1}'' \\ U_2'' \end{pmatrix}$$





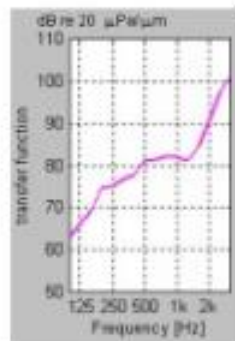
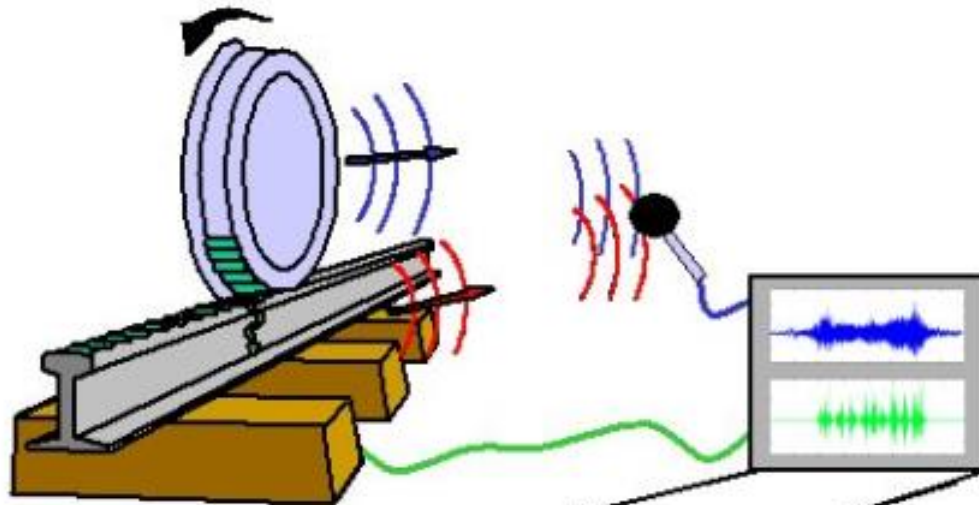
Proefschrift



RECIPROCITY EXPERIMENTS
ON THE TRANSMISSION
OF SOUND IN SHIPS

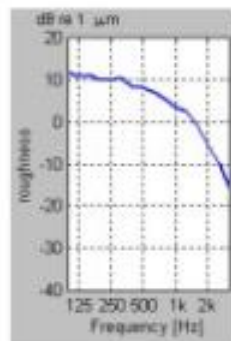
T. TEN WOLDE

Ca. 1980: rolgeluid railvoertuigen



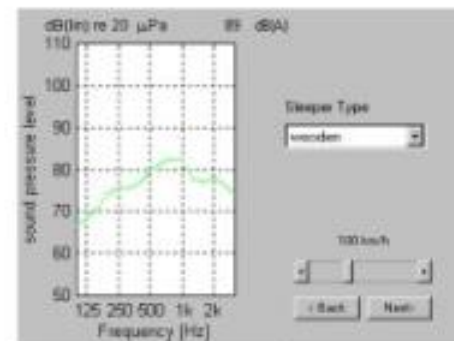
L_H

+



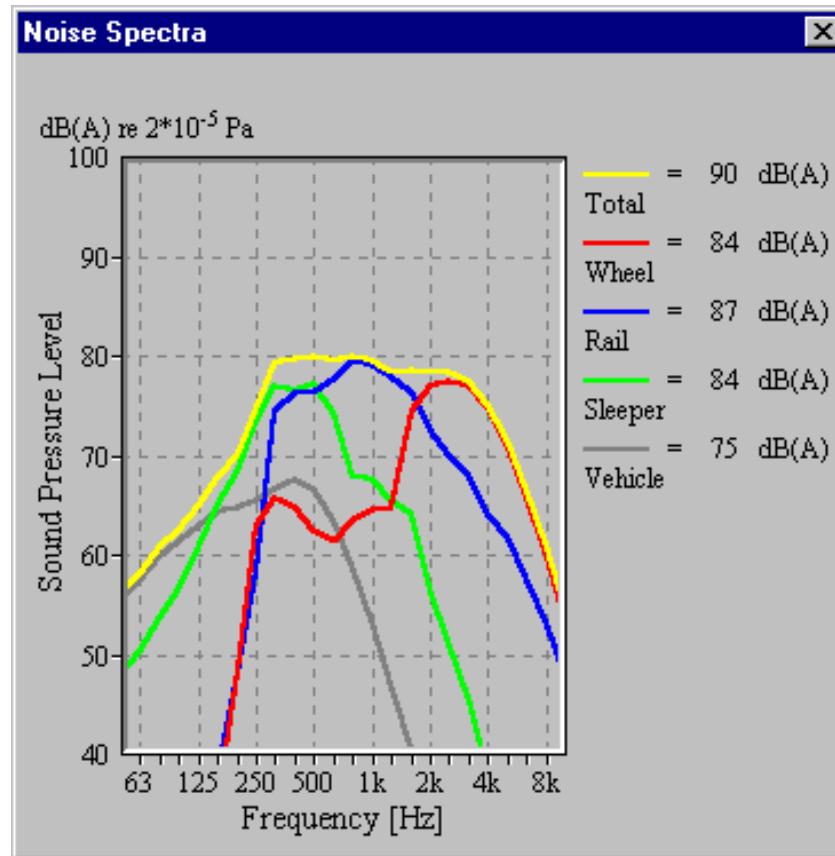
L_r

=

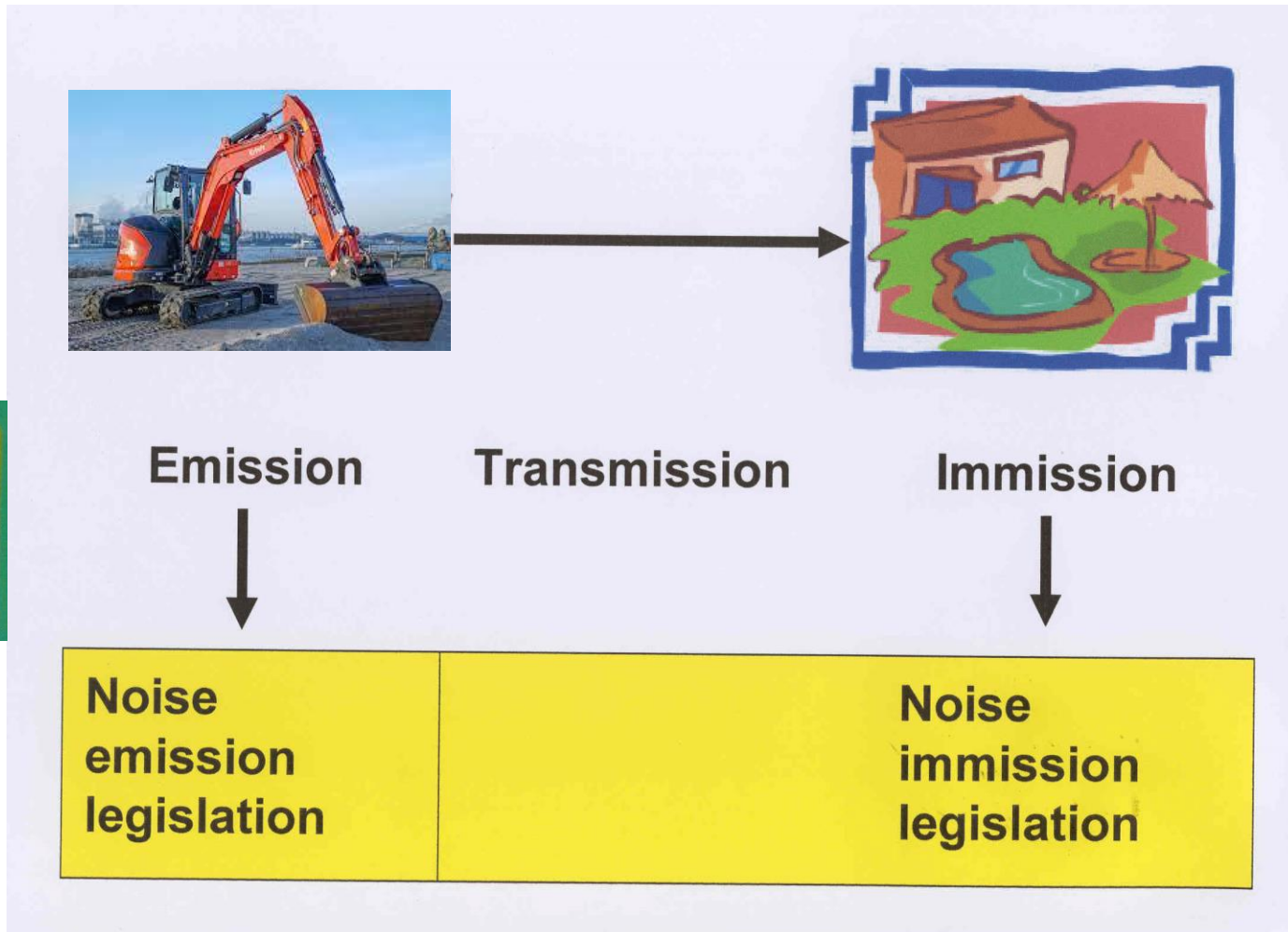


L_p

Bijdragen wiel, rail en dwarsliggers



Ca. 2000: twee Europese Richtlijnen



Richtlijn voor omgevingslawaaai

- Geluidskaarten en actieplannen
- Nodig:
 - 1. Grootheid die goede relatie heeft met geluidshinder : *Lden*
 - 2. Geluidsemissie van weg-, rail- en vliegverkeer, industrie e.a.
 - 3. Overdrachtsmodel(len).
 - 4. De geometrie en aard van de omgeving

Decibel d'Or (2001)



EU-commissaris Wallström

Nevenactiviteiten

- Secretaris/penningmeester Nederlands Akoestisch Genootschap
- Secretaris Nederlandse Stichting Geluidshinder
- Normalisatie
- Voorzitter Ondernemingsraad
- Voorzitter VMHP-TNO
- Redactie blad Geluid
- Voorzitter die Gezondheidsraad
- Organisatie cursussen en congressen
 - Scheepsakoestiek en Railgeluid
 - Inter-Noise 2001, Den Haag

Pensioenperiode (t/m 2010)

- Normalisatie
- 2 Europese projecten
- Bestuur International Institute of Noise Control Engineering (IINCE)
- Rapporten van IINCE
- Cie M.e.r.: lawaai luchthavens
- Keynotes
 - EU-geluidspolitiek (Sevilla, Honolulu)
 - Reciproke meetmethoden (Rotterdam)
- Artikel over reciproke meetmethoden

Thank you



Helmholtz



Rayleigh



Lyamshev



Masha



Verheij



Mason



Geerlings



Van der Linden



Ballantine



Chertock



Ver



Faly



Reciprocity Measurements in Acoustical and Mechano-Acoustical Systems. Review of Theory and Applications

T. ten Wolde

Graaf Willem de Rijkelaan 33, 2263 TK Leidschendam, The Netherlands. tieert.tenwolde@kpnmail.nl

Summary

In 1873 Lord Rayleigh defined the General Reciprocity Theorem for stable, finite, lumped, passive, linear dynamical systems which only contain reversible (bilateral) elements. In spite of Rayleigh's authority, there have been a number of papers expressing doubts about the validity of the theorem for certain acoustical and mechano-acoustical systems. It can be shown however, that these papers are either based on too primitive experiments or on too simple theoretical models. On the other hand there are many publications showing the validity of the theorem. It can be concluded that Rayleigh's theorem is correct.

Flow disturbs reciprocity because it introduces non-reversible elements. Nevertheless, in many systems with flow, the disturbing effect is limited and reciprocity can still be applied.

The most straightforward application of reciprocity is the measurement of transfer functions. Second in order, because it requires two measurements instead of one, is the measurement of acoustical or mechanical source strength by reciprocal substitution. Third in order, because it needs three measurements, is the reciprocity calibration of microphones and hydrophones. Until 1970, only the latter application was known. In the period between 1970 and 1988 the author of this paper and his colleagues developed a number of methods for the reciprocal measurement of transfer functions and source strength in mechano-acoustical and acoustical systems. It was shown that the reciprocal measurement of transfer functions and of source strength has often great advantages over the direct alternatives. Since 1985, others joined the efforts. Particularly J. W. Verheij, F. J. Fahy and I. L. Vér have done very much for the further development and dissemination of the methods. Nowadays they are widely applied in the automotive industry and in the shipbuilding industry, where they are used for transfer path analysis, data gathering for prediction methods, source identification, source characterisation and for radiation measurements. The methods are also applied to aircraft, trains and buildings, but the dissemination of the methods for those systems is less than for cars, trucks and ships. Further applications concern the development of quiet gearboxes, the development of quiet fans, the prediction of the effects of sonic booms and the design of musical instruments.



Wetenschapper

- Ca. 50 openbare publicaties waarvan ca. 10 in “peer reviewed” wetenschappelijke tijdschriften
- Belangrijkste bijdrage: Reciproke meettechnieken.
- 2009 Erelid Nederlands Akoestisch Genootschap