



JJCAAS

5-7 Avril 2023

Contrôle actif des cuivres : le cas du trombone

Vincent Martos¹, Brigitte d'Andréa-Novel², Thomas Hélie³, Henri Boutin²

Equipe : S3AM (Système et Signaux Sonores : Audio/acoustique instruMents)

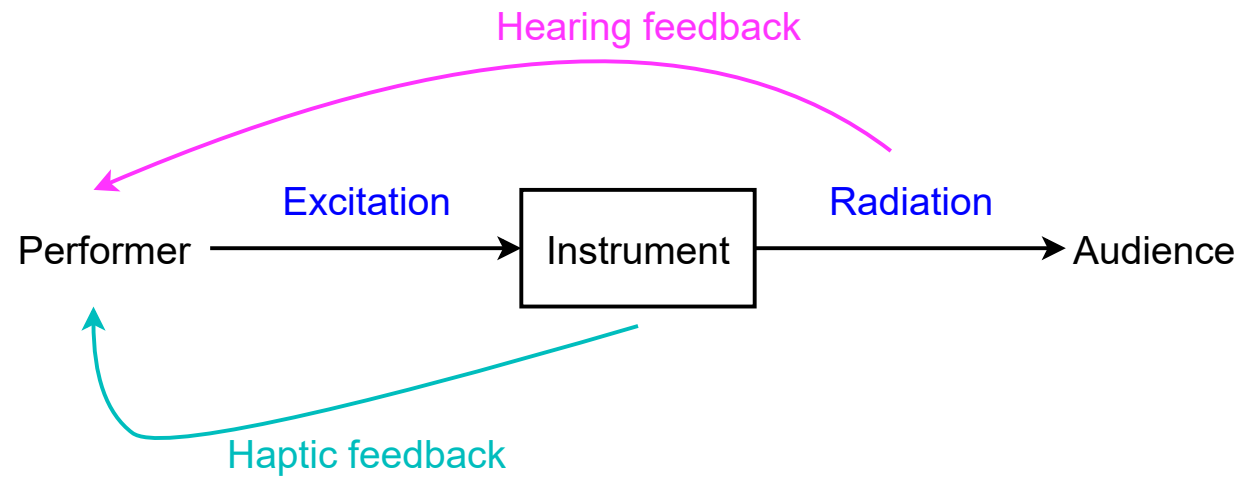
6 Avril 2023

¹SU ED SMAER 391, STMS lab

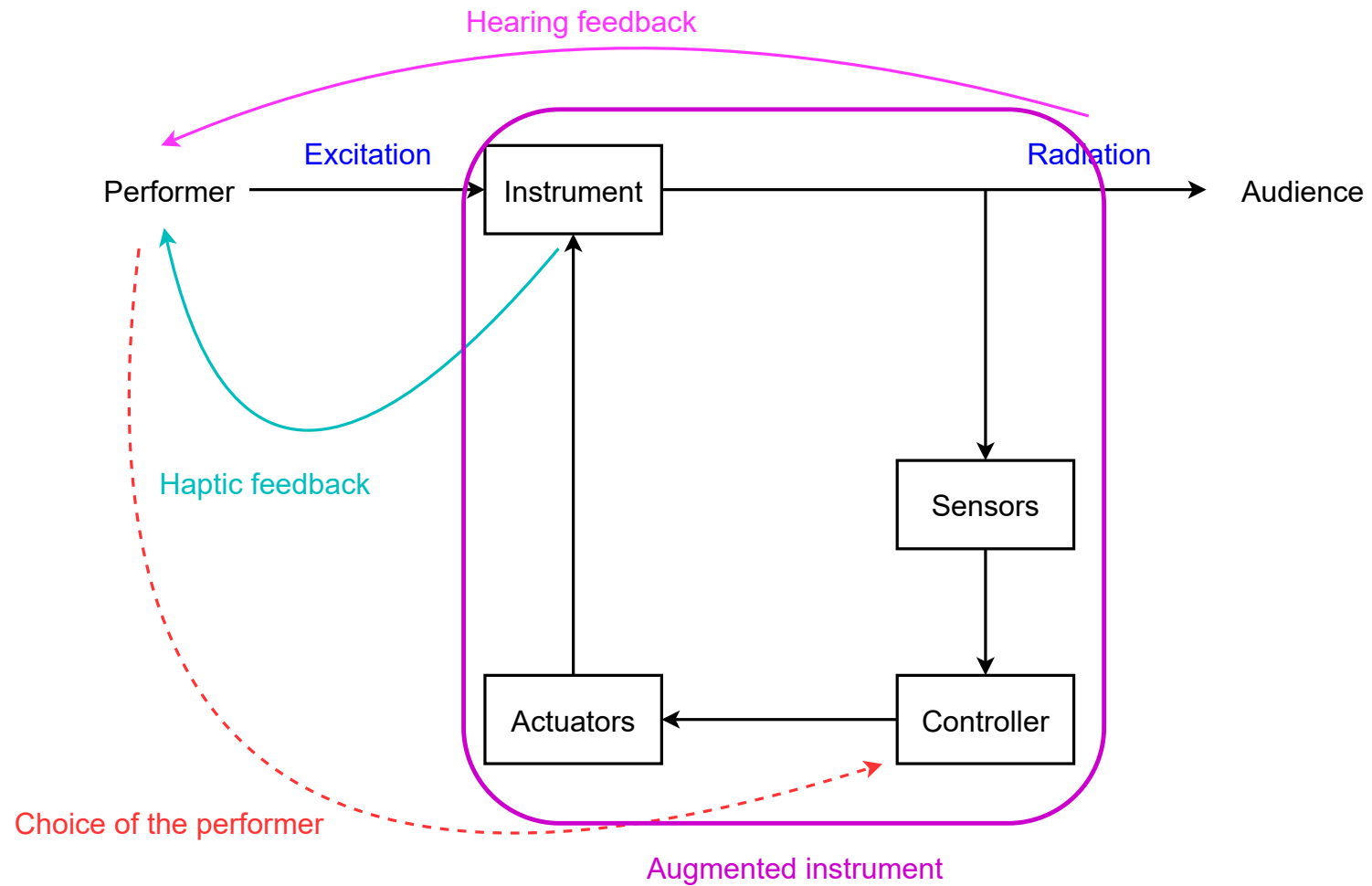
²SU, STMS lab

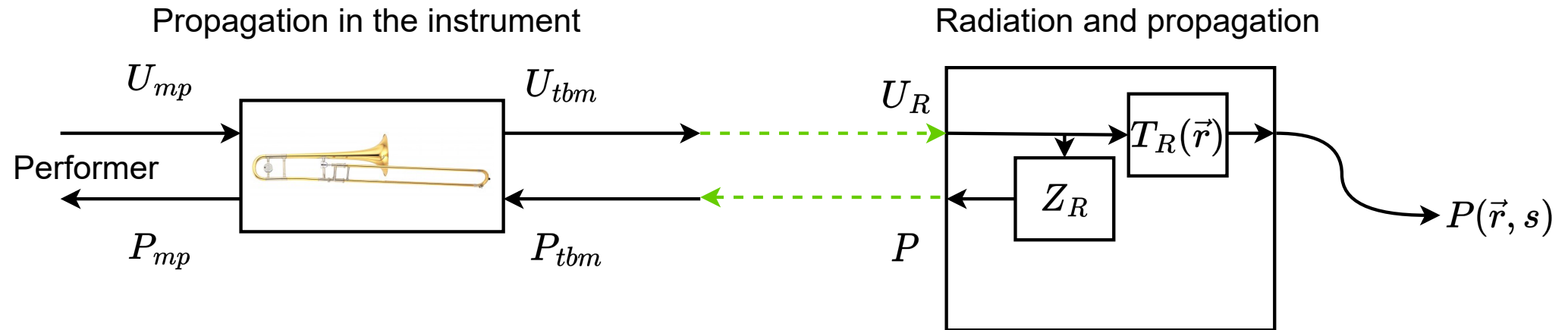
³CNRS, STMS lab

Créer un instrument augmenté

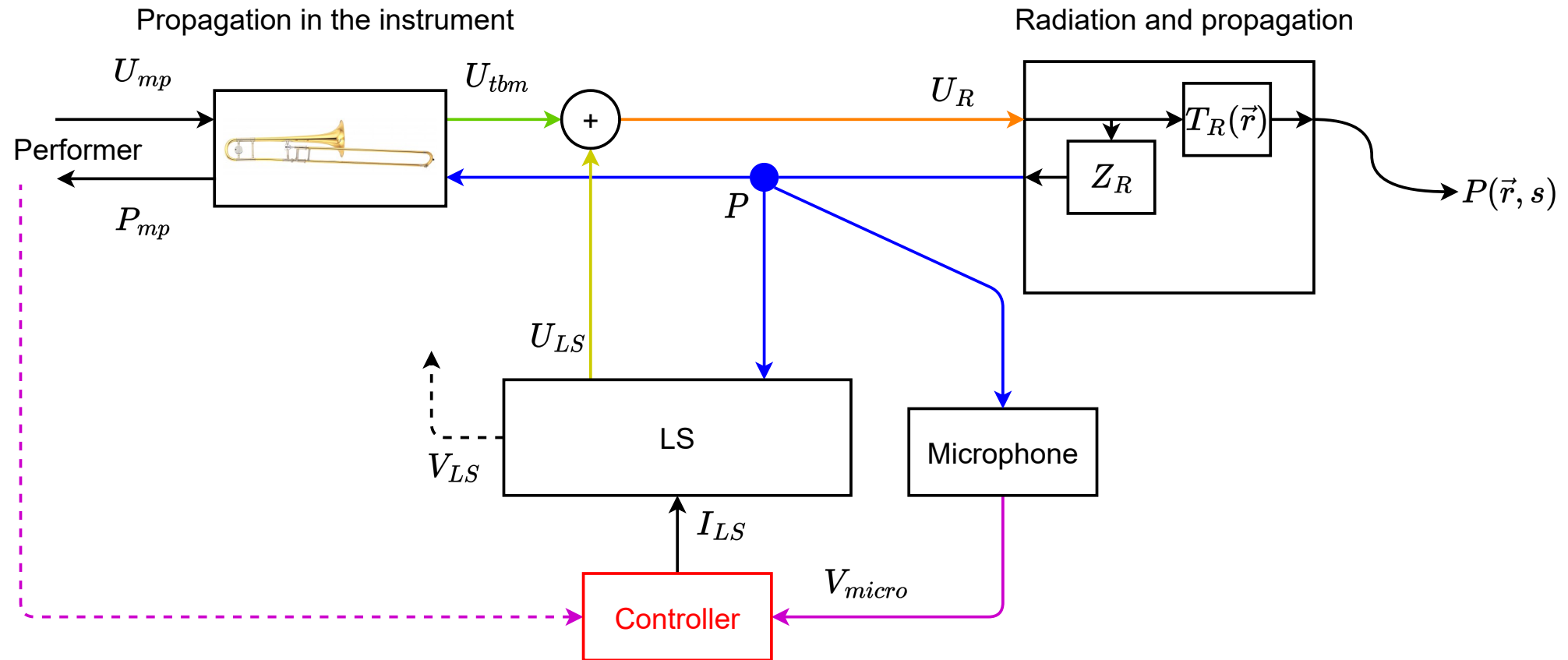


... qui nécessite du contrôle actif





Description du trombone

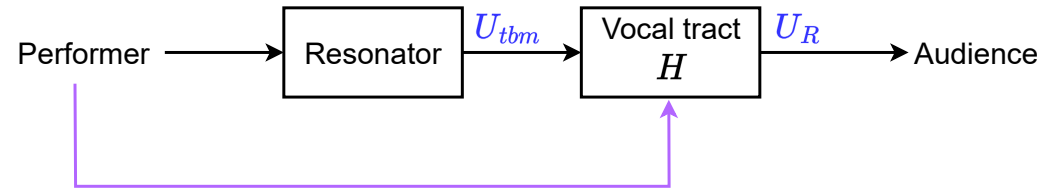


Choisir sa cible

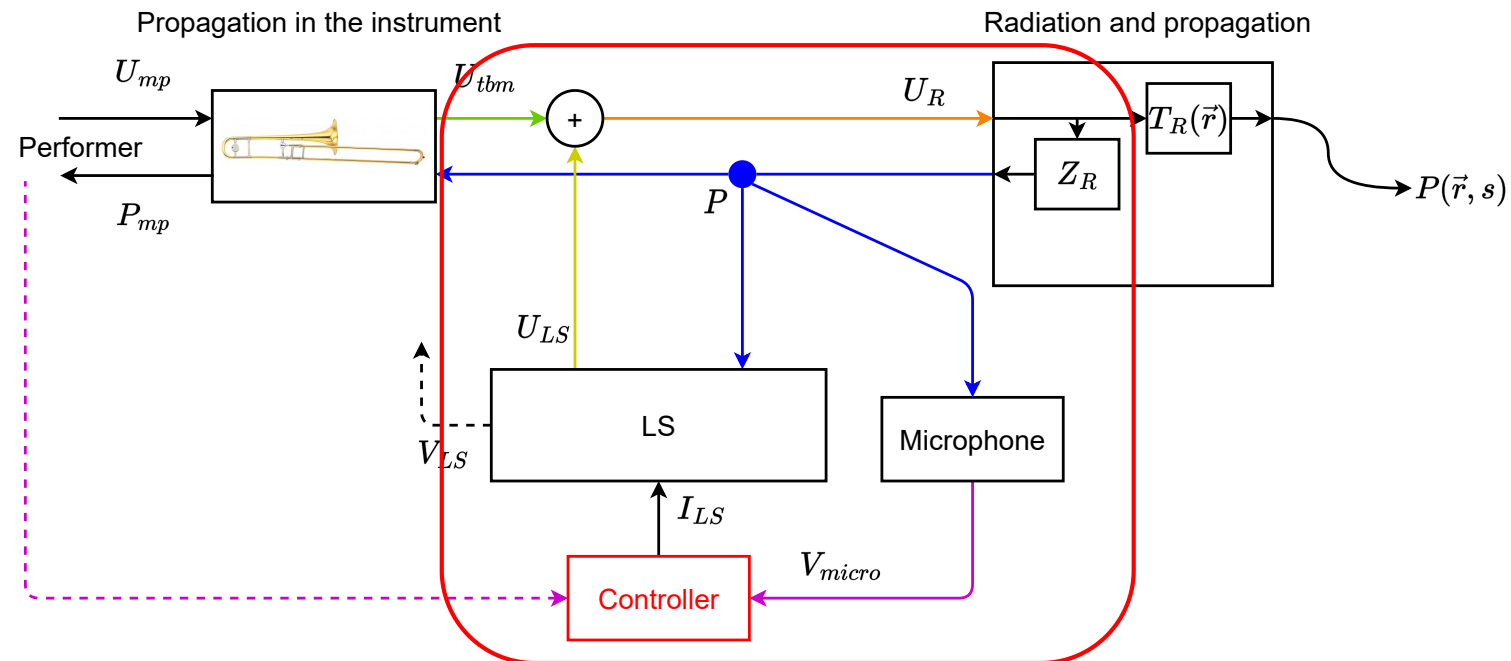
Simuler la présence d'un conduit vocal à l'intérieur du trombone

- Trouver une enveloppe statique de formants
-> choix : H , fonction de transfert
- Déterminer K , tel que $U_R(s) = H(s) \times U_{tbn}(s)$, pour un H fixé

• Cible

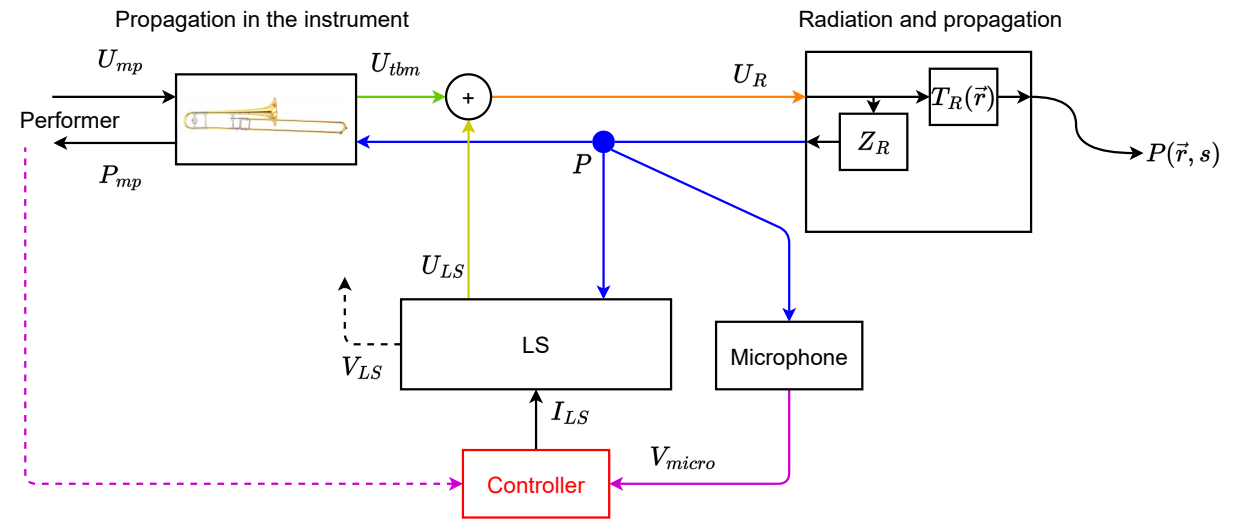


• Solution



- **Cible:** we look for K such that $U_R = H(s) \times U_{tbm}$
- **Definition:** K , fonction de transfert

$$I_{LS} = K(s) \times V_{micro} = K(s) \times \kappa P$$
- **Choix:** SISO control (1 input/1 output)



1 – we can link I_{LS} and P thanks to the **LS matrix**

2 – we use flow rate junction $U_R = U_{tbm} + U_{LS}$

3 – we use the target $U_R = H(s) \times U_{tbm}$

4 – we use radiation impedance $Z_R = \frac{P}{U_R}$

• **Bilan:**
$$K = \frac{1}{A_{21}} \left(\frac{(1-H)}{HZ_R} - A_{22} \right)$$

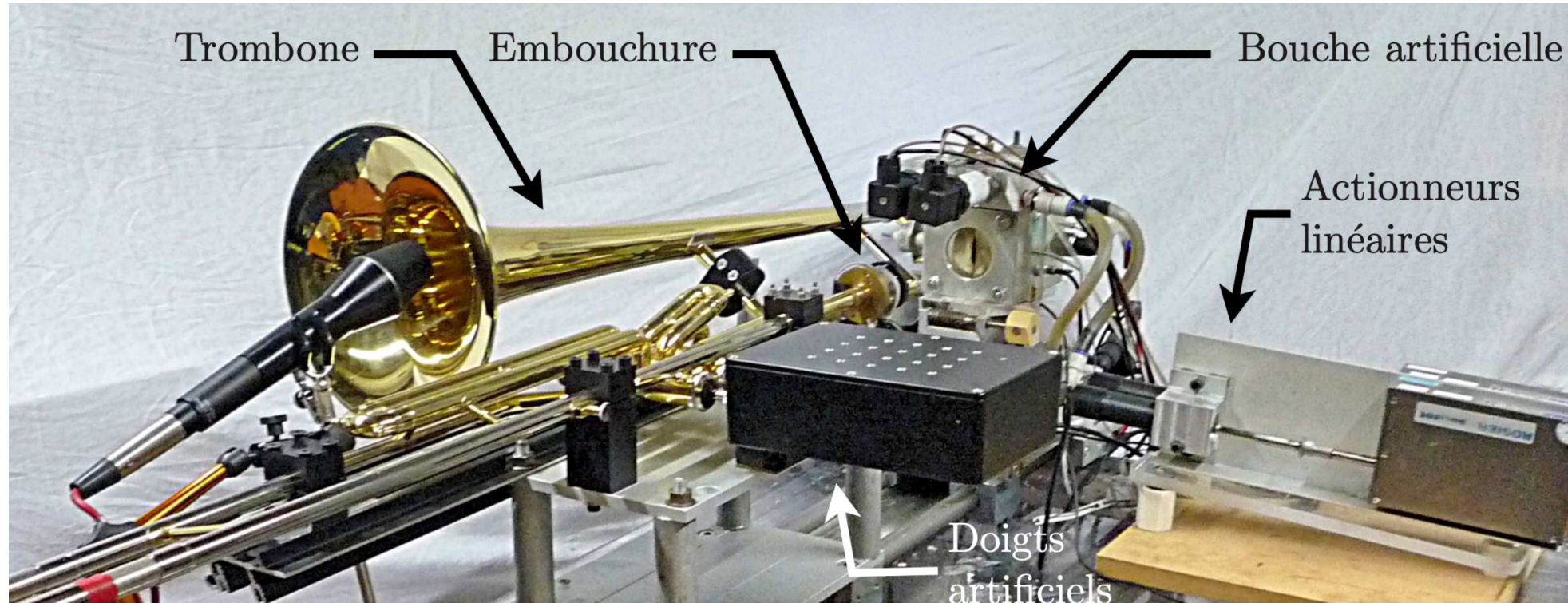
Transfer function: Single Input/Single Output

Depends on Z_R

Un banc de test robotisé

La bouche artificielle¹: un outil puissant

- Target: to have a controllable, repeatable performer to test active control in real game conditions



- General overhaul: checking of sensors and actuators, ordering of parts
- Repair of the electronic part: check of the circuits and replacement of parts
- Sealing of the lips
- First sounds

¹N. Lopes, 2016