How are adaptive PIDs useful?
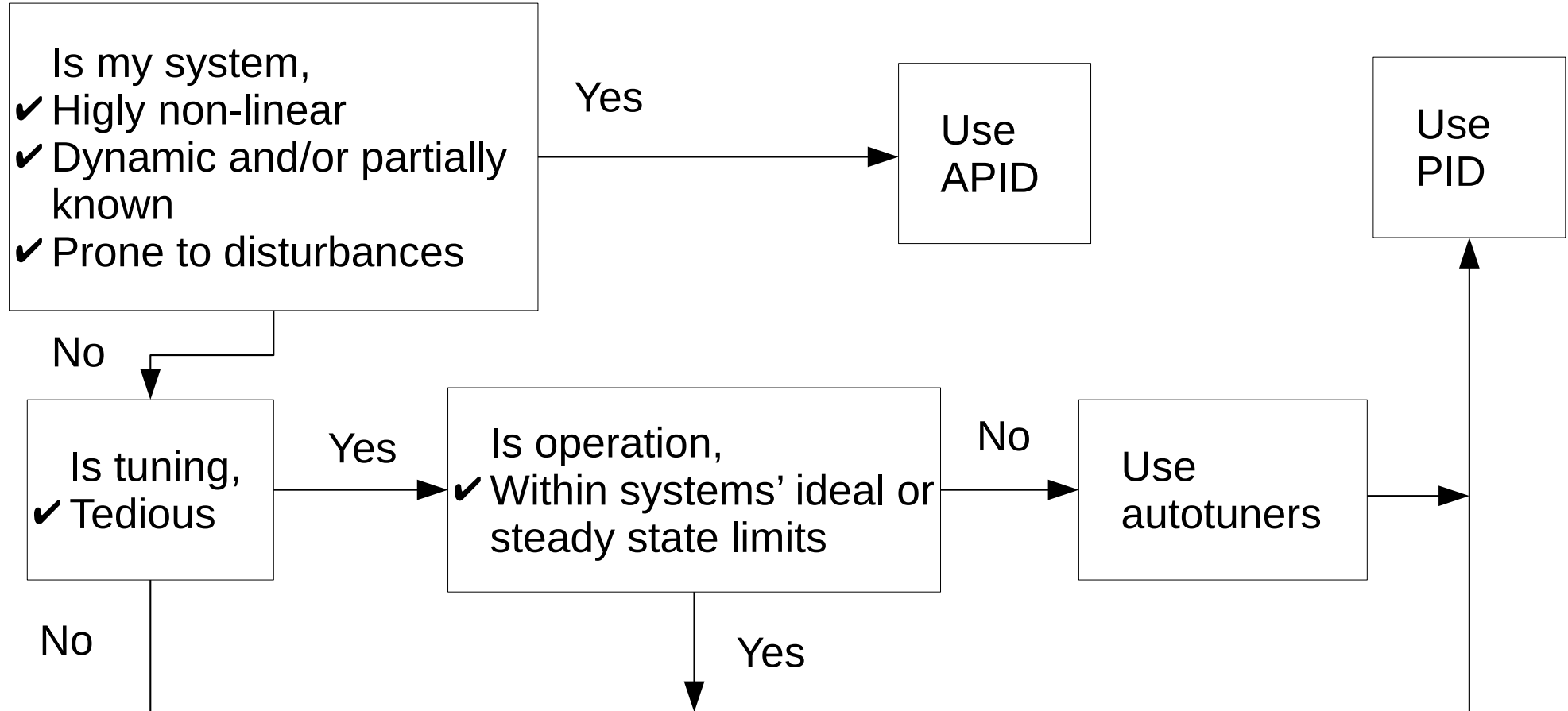
- Real-time automatic tuning which is faster than manual tuning.
- Are more accurate controllers than regular PIDs.
- Preffered when the process system is partially known.
- Dynamic systems can be controlled.
- Disturbances in systems can be present.

When to use adaptive PIDs?

If the system of interest is dynaimc and/or partially known, manual tuning is tedious, prone to disturbances and, simple PIDs fail to achieve desired accuracy in service, then consider a adaptive/self-tuning PID.

	APID	Autotuners
Tuning period	Continuous	On demand
System model	May be required	Not required

When to use adaptive PIDs?

Is my system,
- ✔ Higly non-linear
- ✔ Dynamic and/or partially known
- ✔ Prone to disturbances

Yes → Use APID

No

Is tuning,
- ✔ Tedious

Yes → Is operation,
- ✔ Within systems' ideal or steady state limits

No → Use autotuners

Yes

No

Use PID

Autotuners

Autotuners use tuner methods like Ziegler-Nichols to determine PID constants either on demand or based on a pattern. They can be of two types,

- Process identification combined with a tuning method. -Several process models are available which can approximate most systems.
- Pattern recognition combined with tuning method.

Possible use cases

- Dynamic and non-linearities may arise due to change in pallet load/cargo.
- Operation conditions and wear may increase tyre slip and hence a controller may have to adapt.
- Autotuners may be useful when our system has/can be approximated into few modes unlike a dynamic system which may change at every instant and hence may require an adaptive controller.

Reference paper: Adaptive PID Control of Nonlinear System, R Ghanadan, 1990