



Supplementary materials for

Zhangpeng TU, Yuanchao ZHU, Xin WU, Canjun YANG, 2025. A unified shared control architecture for underwater vehicle–manipulator systems using task priority. *Front Inform Technol Electron Eng*, 26(8):1411-1427.
<https://doi.org/10.1631/FITEE.2400471>

Joint limit function

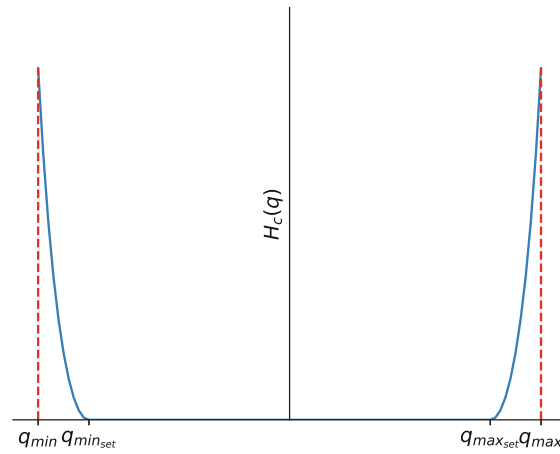


Fig. S1 Joint limit function

Disturbances for each group in the simulations

Table S1 Disturbances for each group in the simulations

Force	Group												
	1	2	3	4	5	6	7	8	9	10	11	12	13
F_{dx}	-6	1	-3	-1	-2	-4	5	-5	5	4	5	-4	1
F_{dy}	-5	-2	6	4	5	-1	2	10	-6	-3	2	0	3
M_{dz}	-5	-6	-1	7	-7	6	-6	-10	5	-4	2	-5	-7

Comparative measurement analysis in the simulations

Table S2 Comparative measurement analysis in the simulations

Statistical analysis	one-way ANOVA, $\alpha = 0.05$
Time	$F(2, 36) = 37.93, p = 1.37e - 09$
USC vs MC	$p = 0.0338$
USC vs AC	$p = 1.14e - 11$
MC vs AC	$p = 9.12e - 08$
Operator input	$F(1, 24) = 8.89, p = 0.0065$
Operator eye movement	$F(1, 24) = 30.45, p = 1.13e - 05$

Comparative measurement analysis in the pool experiments

Table S3 Comparative measurement analysis in the pool experiments

Statistical analysis	one-way ANOVA, $\alpha = 0.05$
Time	$F(2, 24) = 9.58, p = 0.009$
MC vs PSC	$p = 0.0467$
MC vs USC	$p = 0.0004$
PSC vs USC	$p = 0.0454$
Operator input ($F(2, 24) = 8.44, p = 0.0017$)	
MC vs PSC	$p = 0.0389$
MC vs USC	$p = 3.17e - 14$
PSC vs USC	$p = 0.0467$
Operator eye movement ($F(2, 24) = 9.23, p = 0.0011$)	
MC vs PSC	$p = 0.0587$
MC vs USC	$p = 0.0007$
PSC vs USC	$p = 0.0387$

Definitions of the six subscales in the NASA Task Load Index (NASA-TLX)

- (1) Mental demand: mental demand represents how much spiritual energy is required for the task.
- (2) Physical demand: physical demand indicates the level of physical activity needed.
- (3) Temporal demand: temporal demand is expressed as time pressure to perform tasks.
- (4) Performance: performance refers to self-satisfaction in performing tasks.
- (5) Effort: effort represents the physical and mental effort required to complete the task.
- (6) Frustration: frustration describes the emotional state during the task, such as levels of annoyance, stress, relaxation, and satisfaction.