Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)

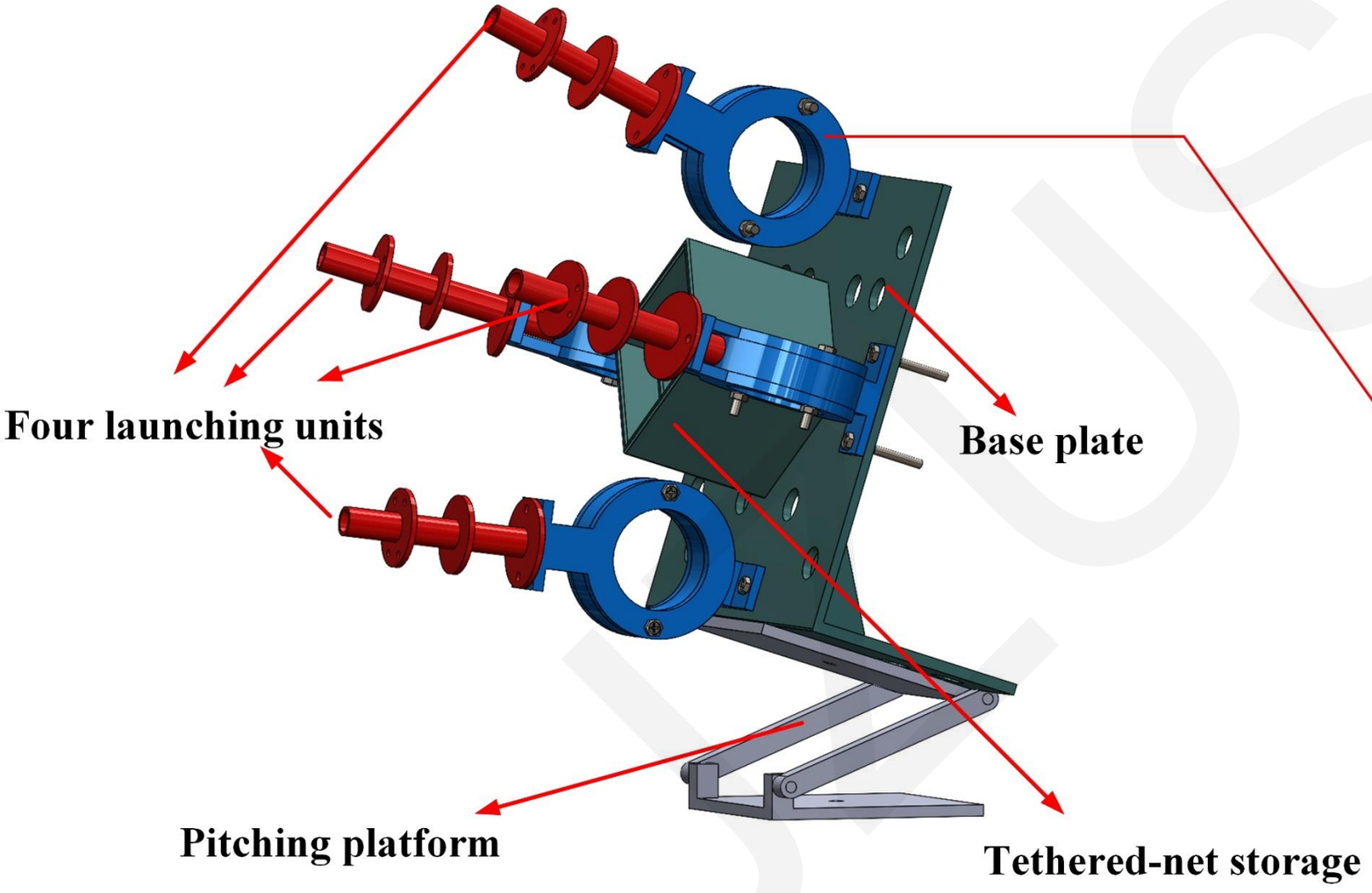
Cite this as: Zongming ZHU, Weihao LUO, Zongjing LIN, Yuzhe KANG, Maoying ZHOU, Ban WANG, Huawei QIN, 2025. Design and experimental validation of an electromagnetic launching mechanism for a tethered net. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 26(1):78-86.
https://doi.org/10.1631/jzus.A2300398

Design and experimental validation of an electromagnetic launching mechanism for a tethered net

Key words:

Electromagnetic launching; Tethered-net launching; High-altitude rescue

Schematic diagram



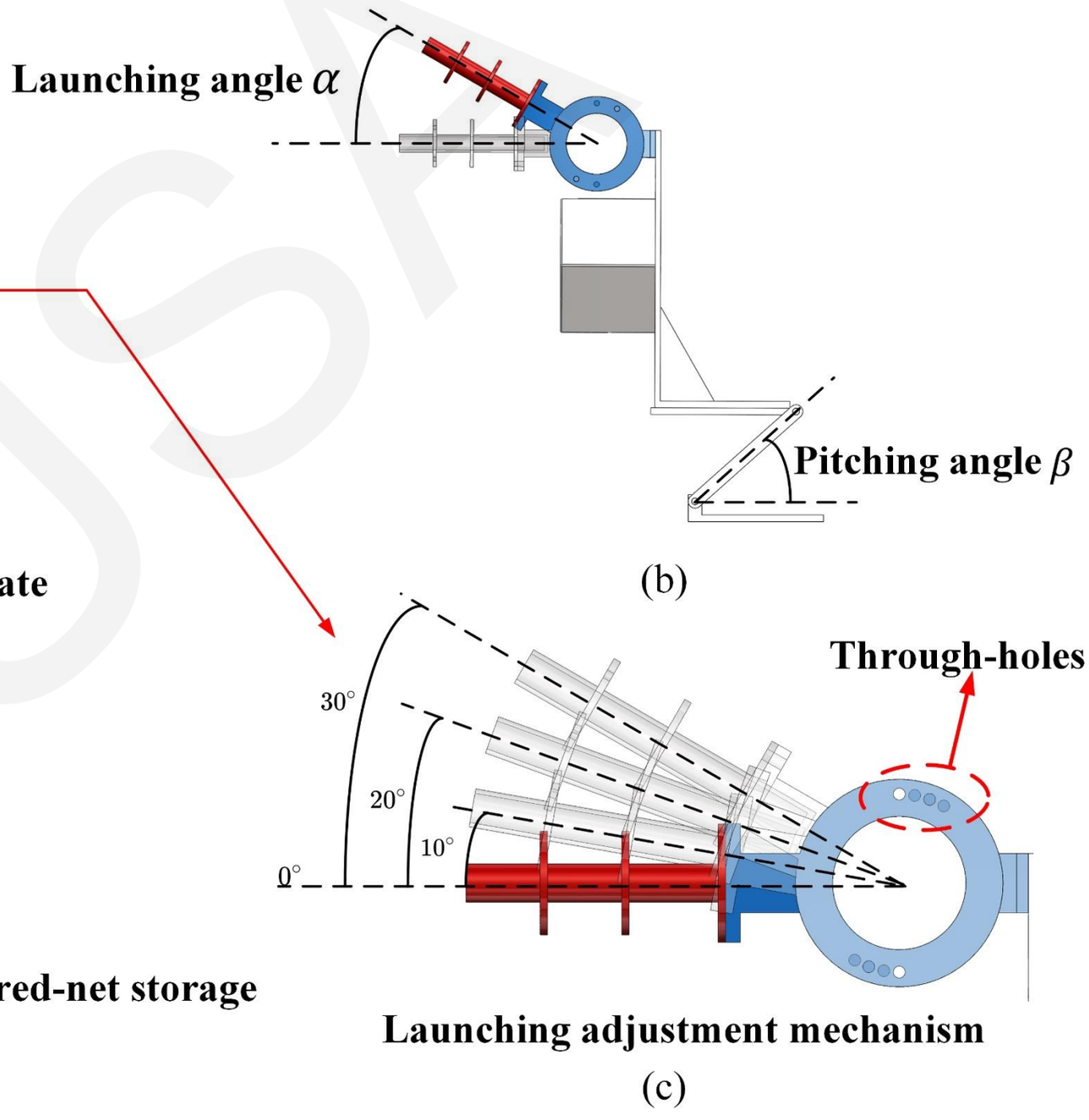
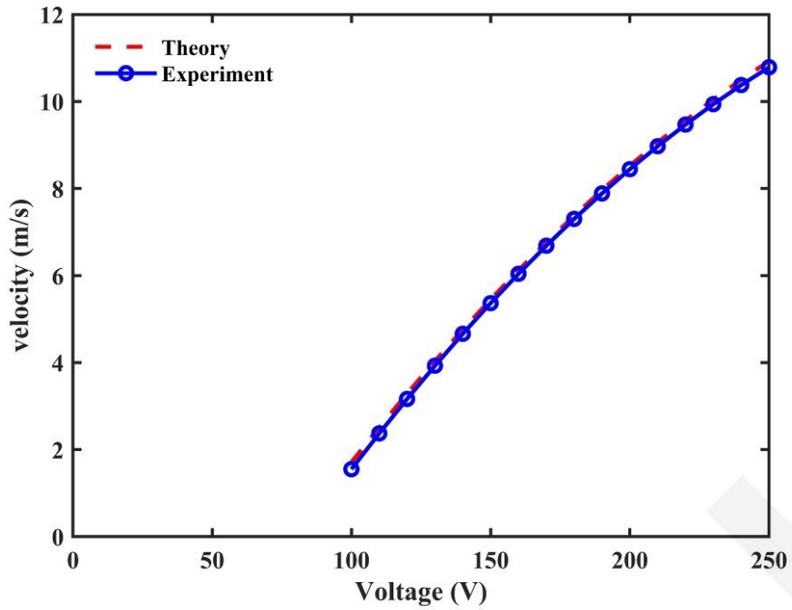
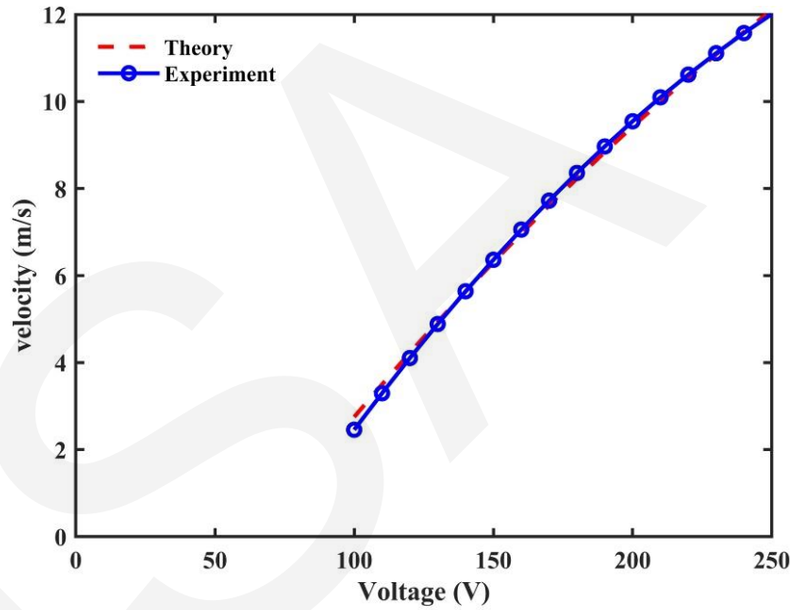


Fig. 1 Schematic diagram of the structure and principle of the tethered-net launcher: (a) schematic diagram of the tethered-net launcher; (b) description of the launching angle and pitching angle; (c) principle of the launching adjustment mechanism

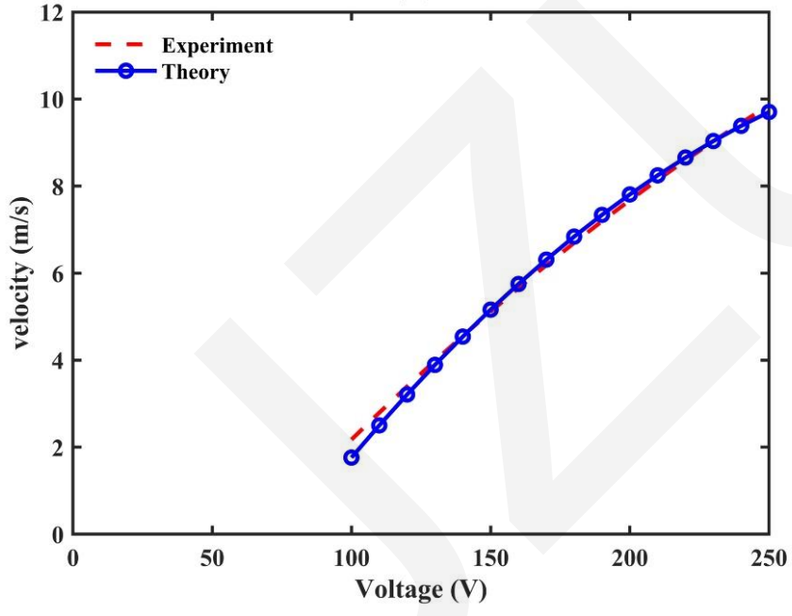
Exit velocity of the projectile



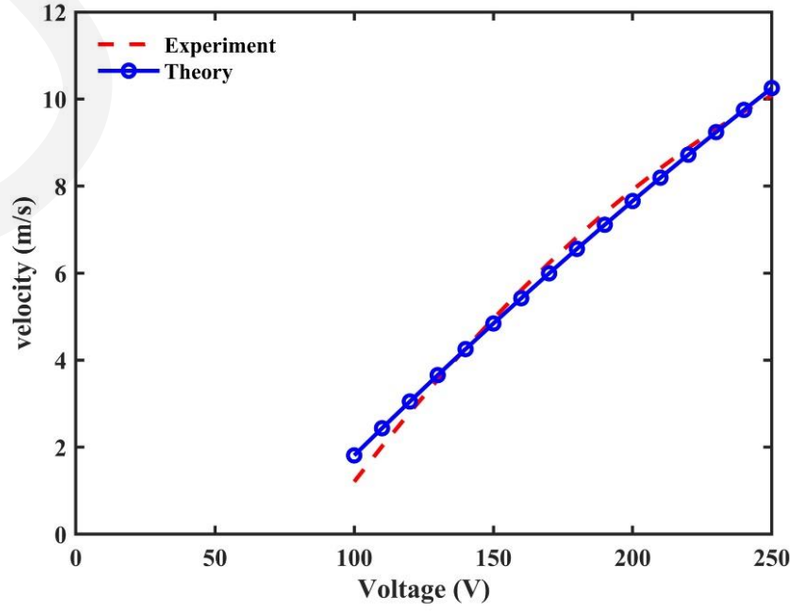
(a)



(b)



(c)



(d)

Fig. 2 Measured exit velocities of the projectile under different charged voltage and wire diameters. (a) 0.4 mm wire; (b) 0.6 mm wire; (c) 0.8 mm wire; (d) 1 mm wire.

Four connection patterns

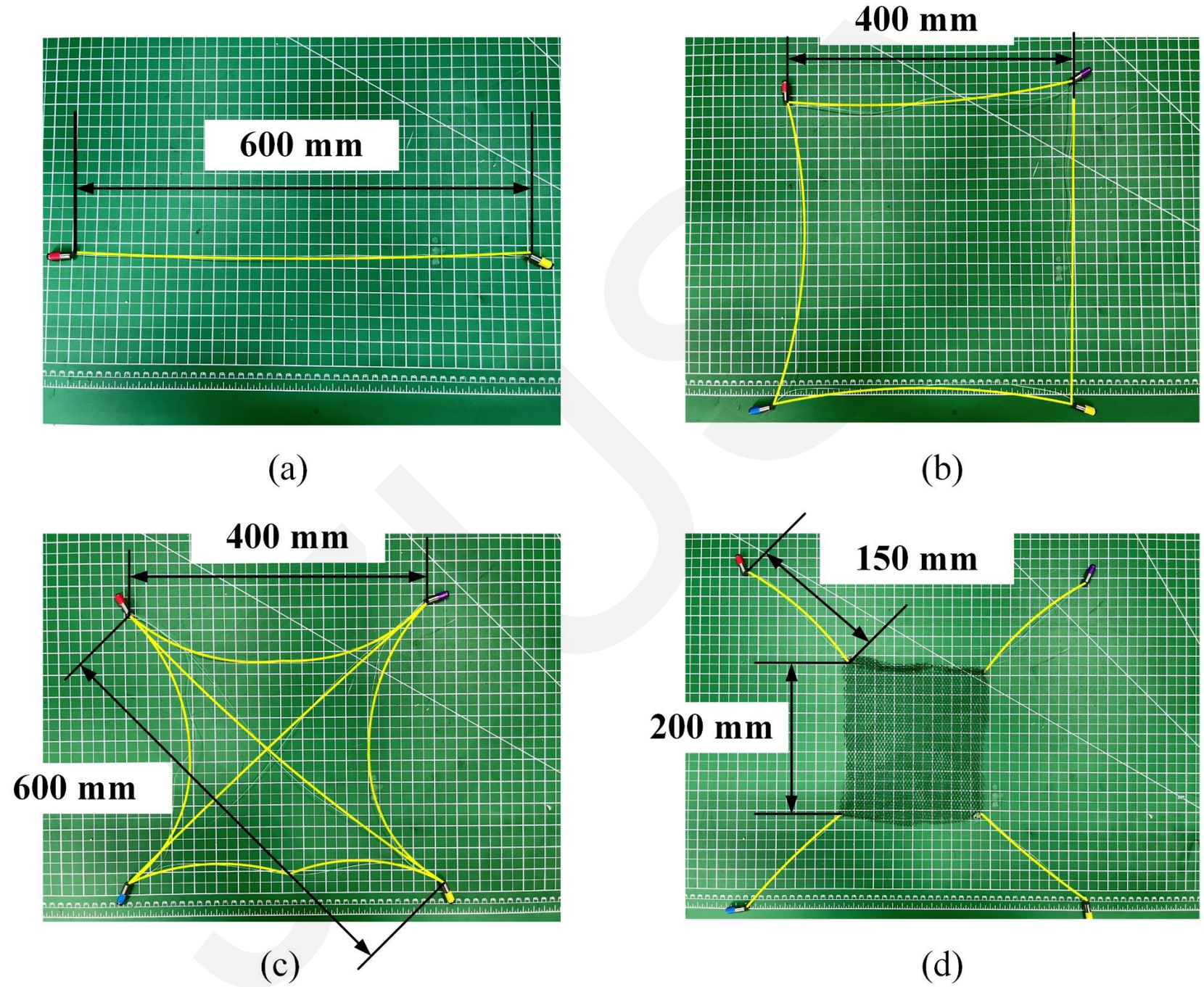


Fig. 3 Different connection patterns between the projectiles and the approximate net(The fishing line in the figure is too thin so that marked with yellow to make it clear). (a) the double-projectile pattern, (b) the square pattern, (c) the cross pattern, (d) and the wire pattern.

Flight of the projectiles

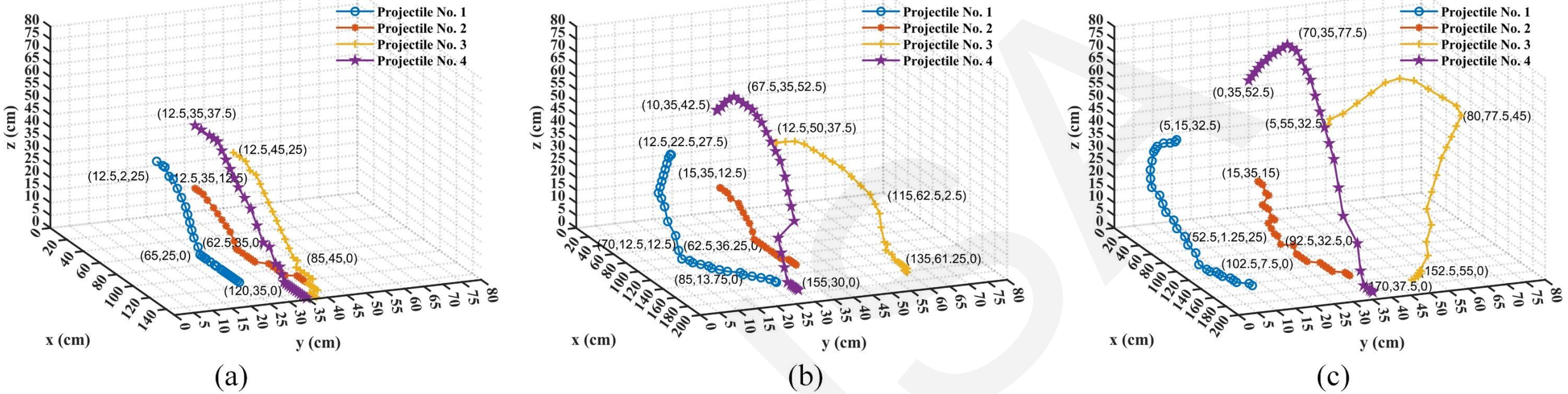


Fig. 4 Flight trajectories of the projectiles in the cross pattern (The initial, bounce-back and landing coordinates of the projectile are marked in the figure): (a) α=0°; (b) α=10°; (c) α=20°

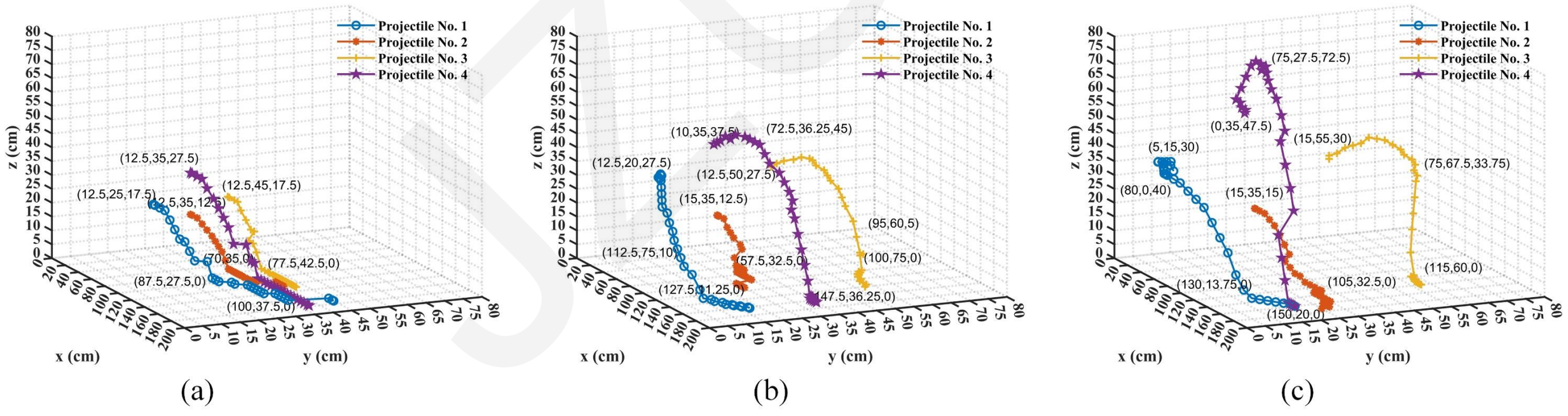


Fig. 5 Flight trajectories of the projectiles in the wire pattern (the initial, bounce-back, and landing coordinates of the projectiles are marked in the figure): (a) α=0°; (b) α=10°; (c) α=20°

Comparisons of the models and the experiments

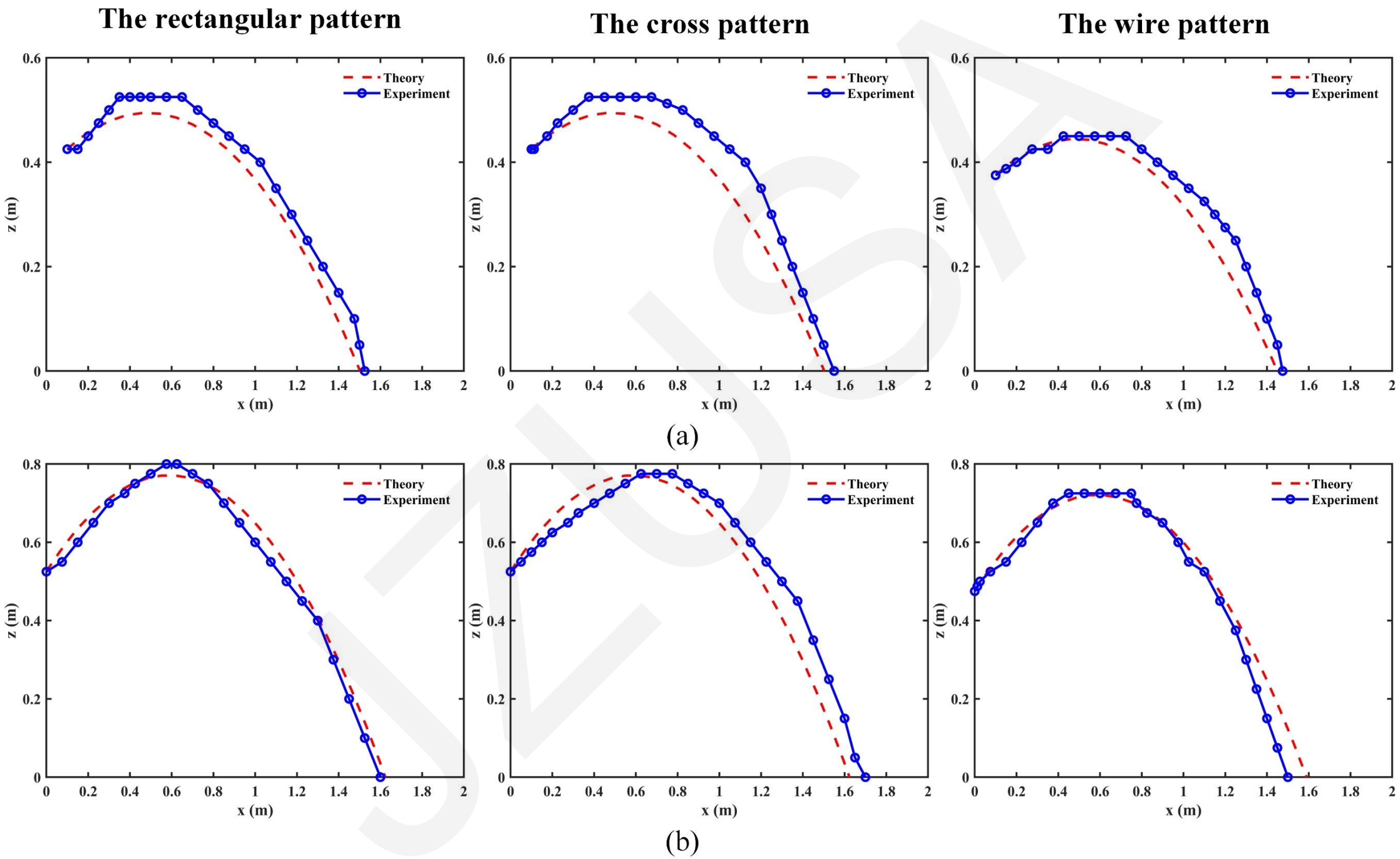


Fig. 6 Theoretical and experimental flight coordinates of the projectiles with different launching angles: (a) α=10°; (b) α=20°

Capture of the object

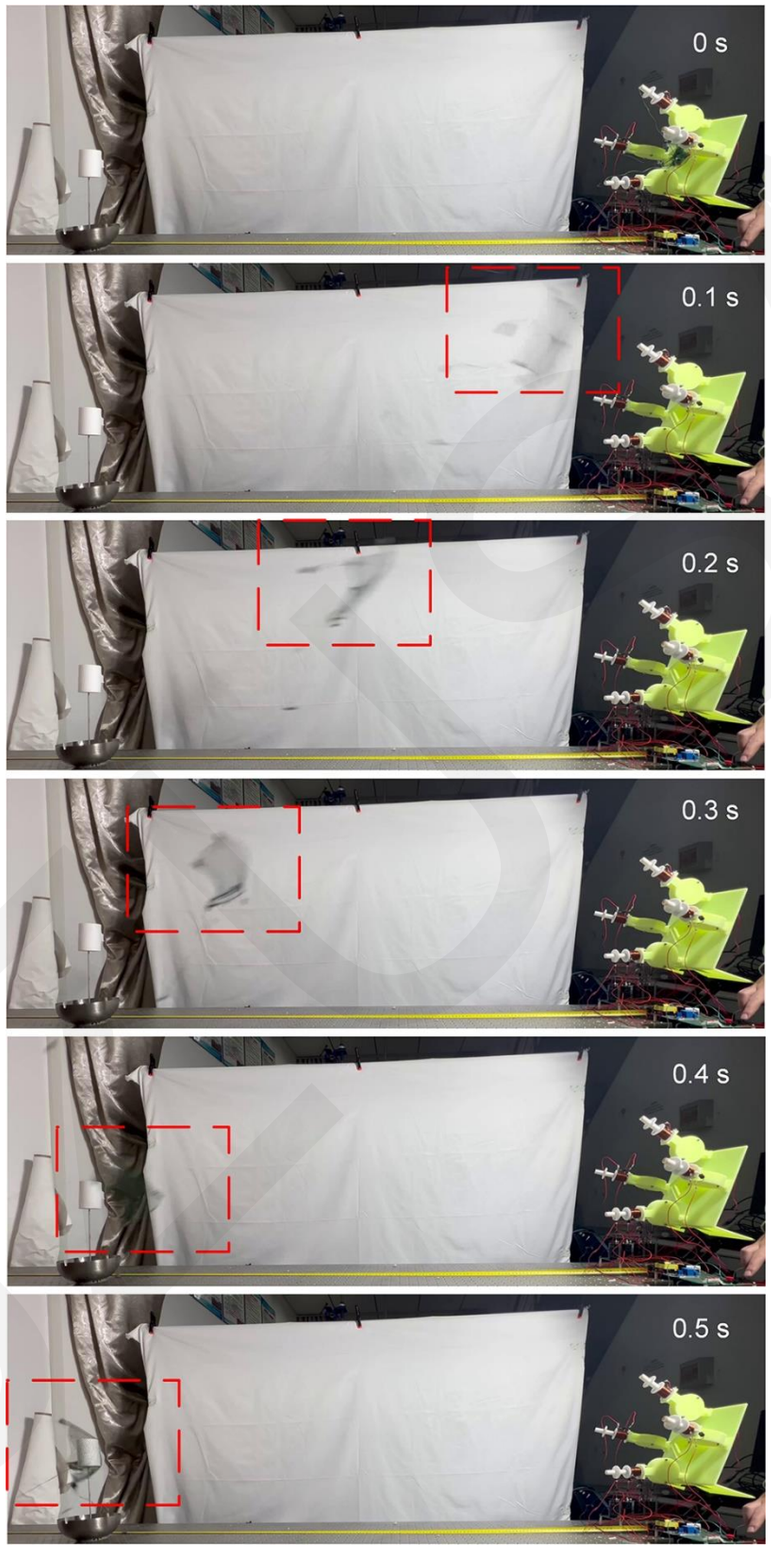


Fig. 7 Positions of the tethered net at different times during flight

Conclusions

- Aiming to provide an effective and safe method for high-altitude rescue, this paper proposes a tethered-net launcher based on electromagnetic launching units.
- The launching performance of the units is characterized by measuring and analyzing the exit velocities of the projectiles and the current in the coil.
- With an increase in the launching angle, the time it takes for the tethered net to be maximally unfolded gradually increases regardless of the connection pattern.
- A simple capturing experiment using the tethered net was conducted to prove the feasibility of the prototype.