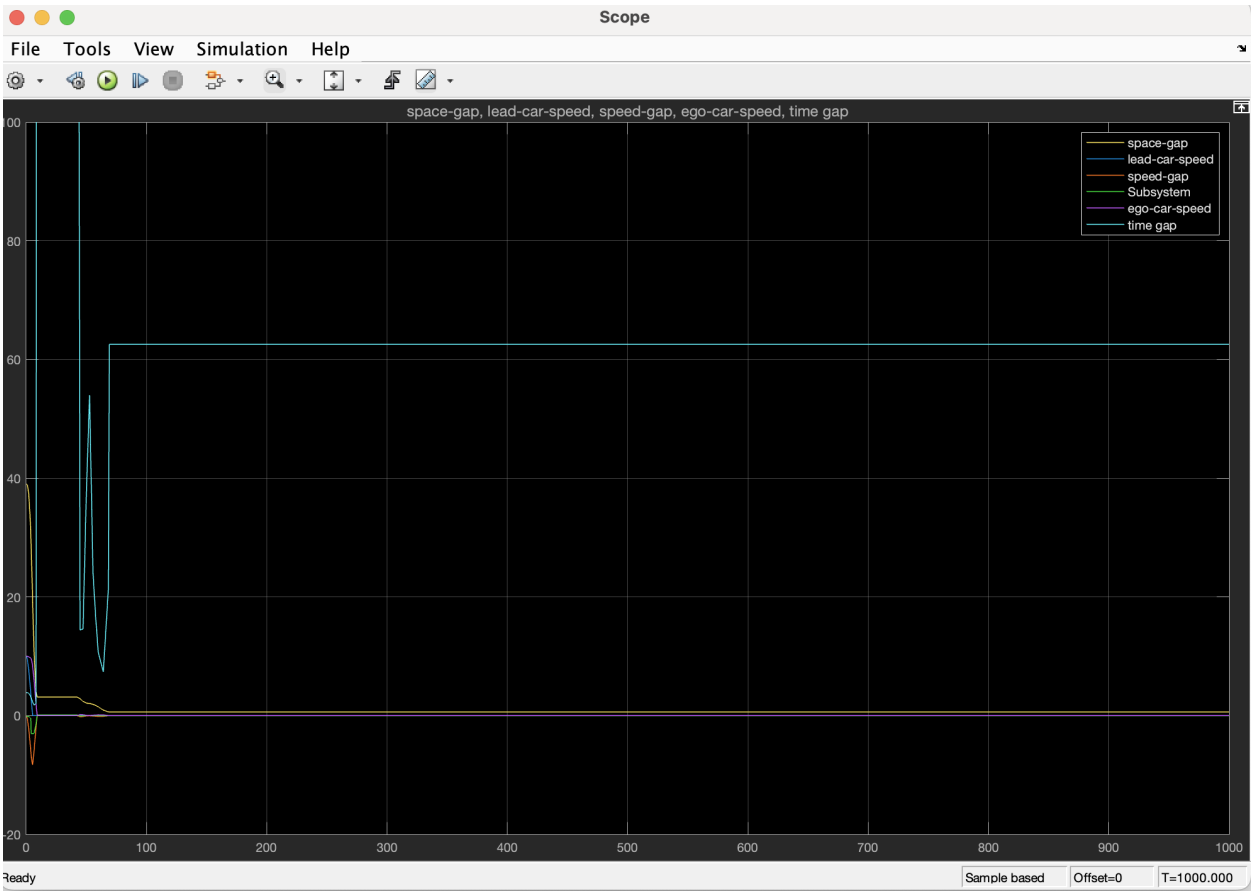
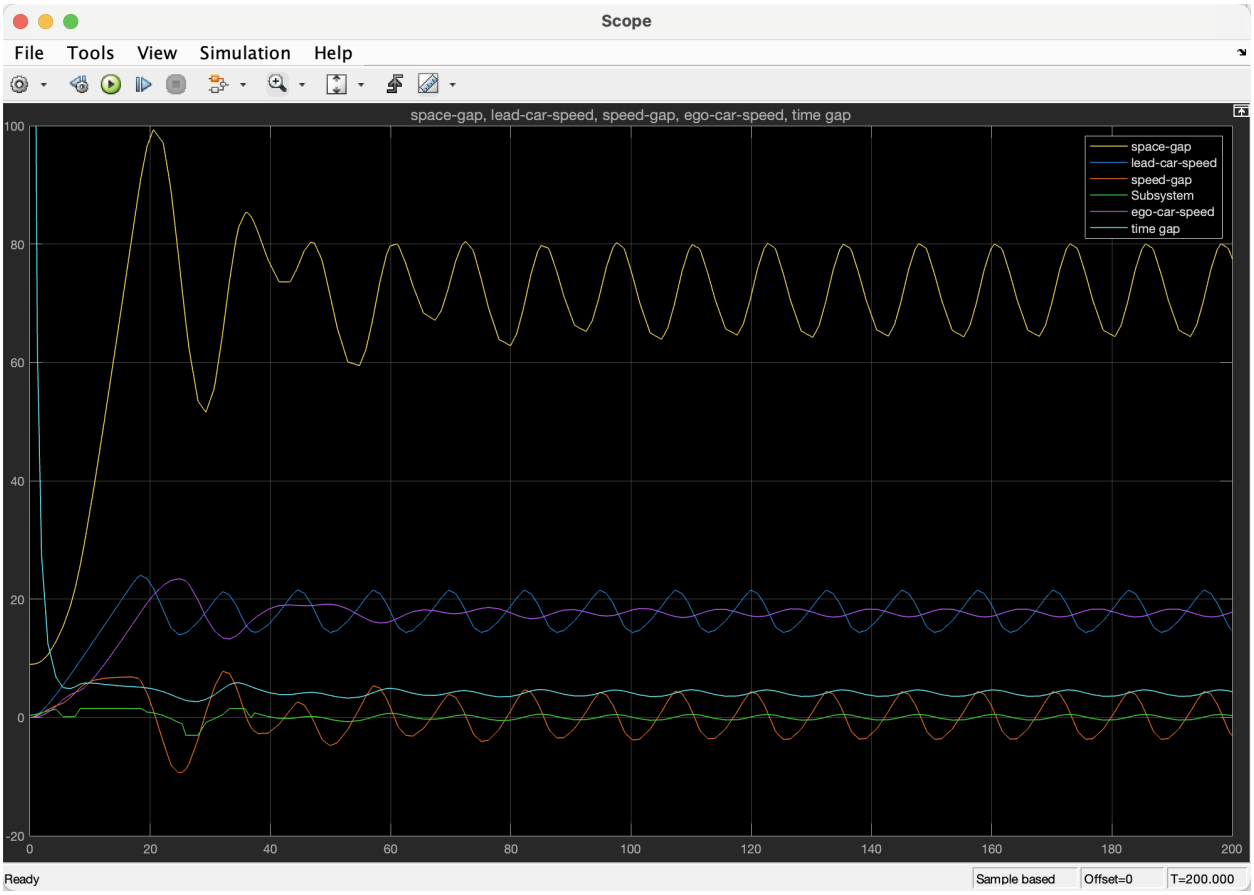
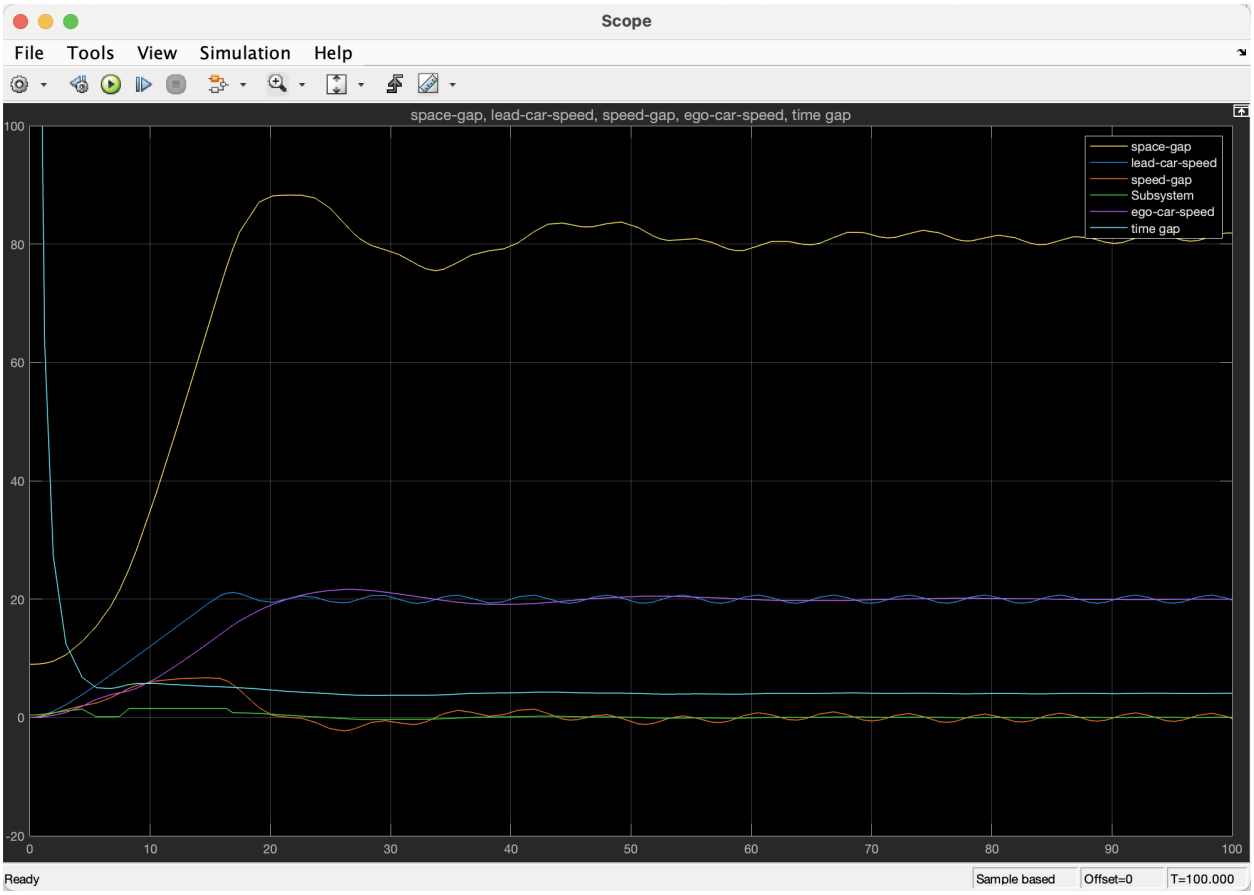
Report

Traditional car-following models handle well when the lead vehicle's speed fluctuates moderately, but they don't perform adequately during acceleration and emergency braking situations. In our first-generation controller, we used relative speed and relative acceleration to compensate for the acceleration in the traditional time gap model. However, this performed poorly when the lead vehicle oscillated around a fixed speed, making it difficult for the following vehicle's speed to converge. In our latest design, we've combined both methods. When the time gap deviation is within 1 second of the expected value, we only use the fixed time gap model. When it exceeds this threshold, we use relative speed to compensate for acceleration. Additionally, we've resolved the traditional fixed time gap model's inability to function when the lead vehicle's speed is zero.

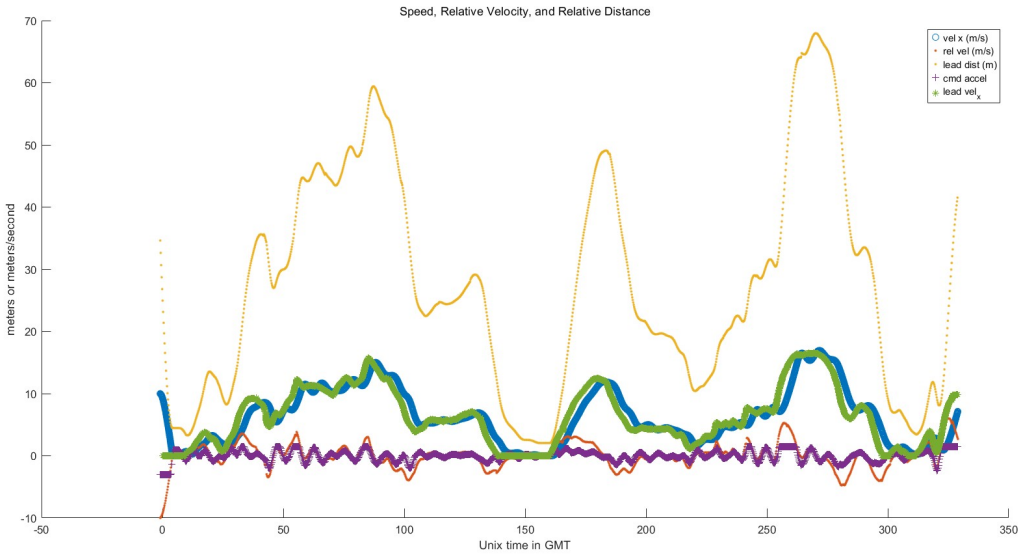


When the lead vehicle performs emergency braking, our vehicle (ego car) can also brake rapidly and ultimately maintain a safe distance of two meters.

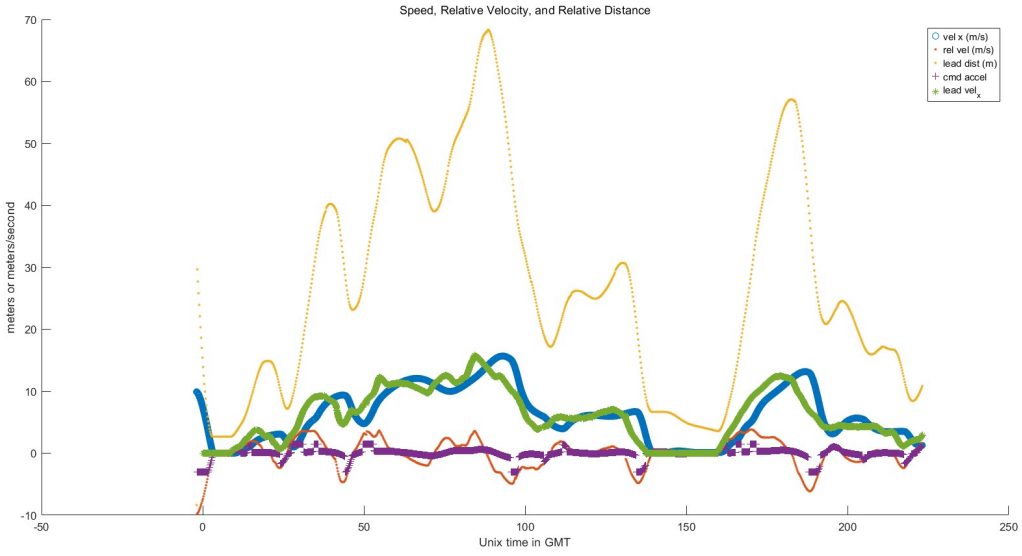




When the lead vehicle accelerates quickly, our vehicle (ego car) can keep up promptly, and when the lead vehicle finishes accelerating, our vehicle's acceleration doesn't significantly exceed that of the lead vehicle. When the lead vehicle oscillates sinusoidally around a fixed speed, our vehicle's speed fluctuations are noticeably smaller than the lead vehicle's and converge well, effectively helping to mitigate traffic congestion.



The traditional fixed-time car-following model aligns too closely with the lead vehicle's speed, being overly sensitive to speed fluctuations which exacerbates phantom traffic jams.



With the improved algorithm, even when the lead vehicle's speed fluctuates rapidly, our vehicle maintains smooth speed changes, which reduces braking behaviors of following vehicles and helps alleviate phantom traffic jams. When the lead vehicle significantly accelerates or decelerates, our vehicle can still respond quickly.